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EDITORIAL NOTES.

Toluol—Work for the Maximum Yield.

THE attention of every engineer and manager of every gas-works, large and small, in the United Kingdom is asked to certain considerations affecting the application of the "C" process to the washing of gas for the recovery of toluol; for this is a matter that to-day is (we may almost say) of paramount importance to the victory of this country and its Allies in the great war. This is a point that cannot be too strongly insisted upon. The war is absolutely one of explosives; and the country that can produce the largest quantity of the bases for the manufacture of explosives is the one that is going to show most material effect in bringing about a decisive issue. This point being well appreciated, it follows that every drop of toluol that gas-works can produce strengthens the position of this country, and places it in a stronger position to help to bring about that ending which is the desire of all loyal Britishers—among whom the gas engineers of the country stand second to none. Their loyalty in the present can be best testified by the work that is put into the recovery of toluol and benzol with the view to securing the maximum under the conditions of their works. Gas undertakings, as a matter of fact, can be looked upon as indispensable factors in the war, by reason of their opportunities for extracting the requisite and invaluable raw materials from their gas—indeed, they are much envied by many other industries for their pre-eminent position in serving the country in the days of its greatest need.

What, therefore, it is desirable should be made abundantly clear is that there is no such thing within sight as getting a larger quantity of ingredients for explosive purposes than will satisfy requirements. Any gas engineer, working the "C" process, who takes the trouble to supervise the details, so as to get even a little more of the valuable necessaries for the making of explosives, is doing a good work for his country. In fact, we would place the matter higher than that, and appeal to every officer in charge of the process to look upon it as an individual responsibility to increase to the utmost the available supply of what is needed. It is acknowledged that there has been great encouragement by the way gas engineers have taken this work in hand, and by, generally speaking, the remarkably good results that have been attained. But these good results have not been uniformly realized from the same coal and with carbonizing systems approximately in similar condition and worked in like manner. Coal and carbonizing systems and working methods are, of course, all factors in the matter of yield of the needed substances; but we do urge—and that with all earnestness—that every engineer should strive to do his best to secure under his conditions the maximum possible quantities. To do this is very much a question of supervision and attention to detail. Sometimes (although the best of intentions exist) something—perhaps incomprehensible for the time, intervenes, and obstructs the achieving of the highest results. There is, however, now available very considerable experience; and by the aid of this and perseverance and keenness, the obstacles to the greatest production can frequently be overcome, and the desired end of doing the utmost possible be realized. A case in point is Newport (Mon.). No one could accuse the ruling executive official there of being anything but patriotic to a fault, and anxious to express his patriotism in deeds according to his opportunities. There, in the initial stages, the recovery was not in point of volume to his satisfaction. Difficulties were met with. But they have now all been surmounted; and the result is a very substantial quantity of toluol. This is the spirit that is required to-day—a discontent, unless the very best is being done for the country in producing the largest possible quantities of the essentials.

At some gas-works, results that, it must be admitted, are very exceptional, are being achieved; and while it would be impossible for all to rival these results, taking into account coal and plant and carbonizing conditions, it should be regarded by all gas engineers as their bounden duty to attain as closely as possible to the best standards set by working results under circumstances similar to their own. One of the highest achievements has been at the Valley Road Gas-Works of the Bradford Corporation. In this instance, a short time ago no less than 7 gallons of toluol per ton of tar were found in one of the consignments to the tar distillers. It is probable that in this case a rich coal was being carbonized; and it would, of course, be impossible for other works—though the best will and the greatest anxiety prevailed—using coal of lower quality to reach such a standard of working as this Bradford result provides. It must be taken as quite exceptional. Speaking generally, the Metropolitan Gas Companies are keenly at work; and, from among Suburban concerns, the South Suburban, the Wandsworth, and the North Middlesex Companies may be mentioned as instances of undertakings that are obtaining good results. From farther afield, as examples of gas-works undertakings whose results are excellent may be given the Liverpool Gas Company, Brighton Gas Company, Rochdale Corporation, Southport Corporation, Leicester Corporation, Wellingborough Gas Company, Dartford Gas Company, and the Denton Urban District Council. From among the smaller works, the Petworth (Sussex) Gas Company may be specially cited as having done remarkably well in this particular line.

From the Scotch works that have adopted the "C" process uniformly good results have been obtained—so much so is this true that it is almost invidious to specially mention any. But examples—and let it be understood they are examples only—are the Airdrie Gas Company, Bailliston Gas Company, Carluke Gas Company, Coatbridge Gas Company, Cowdenbeath Gas Company, Dalkeith Gas Company, Denny Corporation, Dumfries Corporation, Dundee Corporation, Falkirk Corporation, Glasgow Corporation (they should have special mention), Grangemouth Corporation, Haddington Gas Company, Hawick Gas Company, Motherwell Corporation, North Berwick Corporation, Paisley Corporation, Peebles Corporation, Rothesay Corporation, and Selkirk Gas Company. In regard to Ireland, Belfast deserves special mention.

The works quoted in the two preceding paragraphs are representative of some of those providing the finest results. At the same time, there is not the slightest doubt that, taking the gas-works the country through, more could be done; and till that "more" is accomplished, there will not be the feeling that the gas industry is accomplishing all that is within its power. In this connection, a word to the smaller gas-works. There has been a feeling in some quarters that certain works are too small to work the process. This is a great mistake; and it is very desirable that the smallest of works should feel that it is incumbent upon them to work the "C" process with as much energy as the largest works. This is a case where every little helps. And the aggregate result that could be obtained from the outstanding small gas-works would be most valuable. While so remarking, it must be said, speaking generally of gas undertakings, that the number is comparatively small that have failed to come into line in working the process, and that have not fully realized their individual importance in operating to increase the supply of the essentials for the making of high explosives.

However, let us now all be up and doing in this matter to the full extent of our power. Everyone must realize the vast interests at stake to us as a nation, as well as how much now depends upon the supply of explosives. So realizing, let there be resolve—resolve followed by persistent action—that nothing within reason or possibility shall be left undone to secure what our Army and our Navy require to bring the country the fullest measure of victory.

Fuel Economy—Appointment of a Committee.

We felt convinced when Professor W. A. Bone, F.R.S., of the Imperial College of Science and Technology, read his paper before the British Association recently, and proved the prevalence of a great waste of fuel in the country and of valuable constituents of the raw coal, that he had taken up a question which, if systematically and seriously pursued, would, in the result, prove to be of considerable economic importance nationally. Without thorough system and seriousness, without diligence and personal sacrifice, little could possibly be done in effecting good in a matter which is so extensive that it has no bounds other than those provided by the actual utilization of fuel in many modes and for innumerable purposes. When we come to think of the subject in this way—that is, in respect of magnitude—there are seen complexity and difficulties in the road to reformation of such an immense and varied character as would deter most men from attacking them, although the attack has for its objective national as well as industrial benefit. But the greater the task, and the greater the value emanating from its performance, the greater the honour attaching to those who have part in it. All are to-day trying to sink individuality and to think and act nationally; and it was obviously in this spirit that Professor Bone put forward the case urging consideration of the lamentable waste of fuel that is now proceeding, and of the means of realizing advantage by its suppression. It was also obviously in that spirit that he asked the British Association for the appointment of a Committee to take the whole subject into consideration. We are glad to see from an announcement in another column that he did not make his appeal in vain, and that a Committee has been appointed.

Shortly stated, the Committee has been appointed to consider broadly the subject of fuel economy from a national standpoint, and the lines on which public opinion and action in the direction of a systematic control of fuel consumption can best be organized and directed. There is great scope in the reference; and such scope requires that the Committee shall be representative not only of work but of territory. Much will therefore depend upon the constitution of the Committee; and it will be seen that, in the first instance, the gentlemen invited to join the Committee are scientists and technologists who are, through office and work, closely associated with the promotion of the application of science to diverse industries. At present, the nominated Committee consists of fourteen members, representing the powerful industrial areas of London, Manchester, Birmingham, Leeds, Sheffield, Middlesbrough, Cleveland District, and Glasgow. The names of the members are mostly well known to the professional men of the gas and coke-oven industries. Professor Bone is to be the Chairman of the Committee; and, in addition to him, Professors John W. Cobb (Leeds University), Thomas Gray (Royal Technical College, Glasgow), and L. T. O'Shea (Sheffield University) represent departments of applied chemistry, specializing in the direction of coal gas, coke-oven, and fuel industries generally. Professors J. B. Cohen, F.R.S. (Leeds University), and Mr. E. D. Simon, of Manchester, are both workers on the subject of atmospheric pollution by smoke. Professors P. P. Bedson (Armstrong College, Newcastle-on-Tyne), Harold B. Dixon, F.R.S. (Manchester University), and W. P. Wynne, F.R.S. (Sheffield University), are all eminent scientists. Professor H. S. Hele-Shaw (of London) represents engineering; while Mr. Ernest Bury and Dr. J. E. Stead, F.R.S., represent metallurgy. Professor Richard Threlfall, F.R.S. (Birmingham), and Dr. G. T. Beilby, F.R.S., are both of them very eminent chemical technologists and engineers.

It is a strong constitution. But the Committee has power to add to its number; and, after a preliminary discussion of the lines of work, it is probable some representatives of specific industries will be co-opted—such as mining, coal gas, pottery, iron, and steel. It is also possible that the Committee may be divided into Sub-Committees for the special consideration of particular phases and aspects of the subject, co-opting for this purpose gentlemen with special experience. This, we believe, may be the reason why, in the first instance, representatives of special industries were not nominated. What was desired was to get each of the principal industrial areas represented by some well-known chemist and technologist, who from his position can take a broad and disinterested view of the subject, and can advise as to the best men of the district practically associated with industry whose services in the deliberations of the Committee or Sub-Committee would be of value.

There is a large work here fraught with great economic advantage; and we wish the Committee may in that work realize the fullest success.

The Industry's Work at the Leeds University.

The annual report of the Livesey Professor [reproduced in other columns] is scored all over by the effects of the war; but Professor John W. Cobb is not the man to allow an adverse circumstance to even temporarily completely annul the value of the department under his charge. He bows to the inevitable, but does his best to lighten the situation. Students from the coal gas and fuel industries desire to serve their country directly at the front, or, if they are unable to get to the front, they feel they cannot afford the time for study while the country, in the time of great crisis, can be more immediately served by their work in other spheres. They have therefore temporarily taken flight. Even Mr. H. Hollings has been permitted to suspend the Exhibition Scholarship, and enter the laboratories of the South Metropolitan Gas Company, and to employ his time on war work. But there will be at the end of the war compensations for the present dearth of students.

We are then going to live a new life industrially—at least, so we all hope, and are led to believe. In the gas and coke-oven industries, as well as in other manufacturing quarters, there will be scope for many more scientifically and chemically trained men who can give technical supervision, of which there is a confessed lack to-day. The services of such men are wanted in the gas industry to a larger extent than they are engaged at present, and more than ever on account of the development of plant and processes. In this development and in the economies to be derived from chemical control, there is plenty to be done within the works; and outside trained brains are required to get into touch with work in other industries, in order to help to base the applications of gas in those industries on the surest and most useful foundations. The Sulphate of Ammonia Association and the London Coke Sales Committee have recognized the value of the technical expert in developing commercial work among those who are not in closer touch with the gas industry than as customers or possible customers for those products. Economical working should follow the advent of the scientifically trained man (whose training has been specialized); and the highest level of economy should be maintained by his supervision. We have had some actual practical illustration of this, and have been satisfied that there is profit, represented by hard cash, in an undertaking's investment in chemically trained assistance. The same thing was illustrated at the British Association meeting in connection with the coke-oven industry. The South Wales coke-oven plants have also been locally arraigned as the sources of much waste, owing to the absence of chemical supervision. However, the various industries whose processes present openings for chemical control must be worked up to full appreciation of these things. The war is helping in this direction. Given the demand, the Universities and Technical Colleges—the Leeds University among them—specially devoted to scientific training for industrial operations will have a busy time in preparing a constant stream of men for a larger and more useful life in the actual productive work of the world. The temporary break in activity occasioned by the war is, we hope, only the lull before the storm for the Universities and Technical Colleges.

But though Professor Cobb is having a comparatively lonely existence just now, through the loyalty to country of those who would otherwise be studying under his direction and assisting in the research work of the department, he is by no means idle, helped by the few remaining to him. His report shows that between them they are keeping afloat the investigations that were previously taken in hand on behalf of, and in consultation with, the gas industry. Outside the laboratories and lecture rooms, Professor Cobb and his assistants are also carrying on good work for the gas industry, by bringing certain of its problems before the chemical societies. For years the gas industry lived within itself, and did not pass beyond its own borders. Except the limited number in actual service in the gas industry, few chemists knew little, if anything, about the work and products of the gas industry, about the fascinating problems surrounding them, and about the processes that yield products which are basic in other industries. As to the primary

product of the industry, outside chemists had the most crude notions as to its applications and effects—as crude, in fact, as the layman, or the electricity salesman, without an atom of chemical knowledge. The last few years have seen a change coming over this condition of things. Many papers on matters affecting the technical interests of the gas industry have been read before chemical and other scientific societies. In this, Professor Cobb has lately been taking part. It is all to the good. The more the industry and its work are known by influential bodies, the better. All possible help is wanted by the gas industry from those who can be of service to it in other industries; all means of removing fallacy is desirable. We are on the right road in this matter; and by the assistance of the Livesey Professor and others who have close association with the gas and fuel industries, and can act as connections between professional gas organizations and other scientific and technical bodies, there will be valuable development.

Heat Treatment of Iron and Steel by Gas.

THERE is considerable practical value in the research work that Professor A. H. White is carrying on, in collaboration with his assistants and students, in the Chemical Engineering Department of the Michigan University. We have further examples of this in two papers which Professor White and Mr. Homer T. Hood have presented to the Michigan Association. One is on gas as a case-hardening agent, and the other deals with the heat treatment of iron and steel in a neutral atmosphere; and the materials for these papers are provided exclusively by investigation. The paper on the second subject is reproduced in our columns to-day; and it has a significance and value which, in our view, exceed the actual results achieved by the reasoning, invention, and experiment as set forth in it. It will be seen that the paper carries us beyond the usual lines of research work in relation to the industrial applications of gas; and we think it, as well as the companion paper, will be an incentive to others to prosecute work in new directions with the view of enhancing the efficiency of gas in manufacturing operations. Up to now, investigation in the matter of the application of gas to industrial heating has been largely limited to the improvement structurally of burners, furnaces, muffles, &c., with the view of realizing the largest heating efficiency from the gas consumed. On behalf of the utilization of gas in industrial heating, claims, too, have been based largely on availability, time economy, heating efficiency, temperature uniformity, means of temperature regulation to requirement, and improved quality of product as a result of this uniformity and capacity for regulation. All this is good, but it is not enough; and the question which, we imagine, must have preceded Professor White's and Mr. Hood's joint researches into the heat treatment of iron and steel was, Can the gas system of heating furnaces and muffles be so manipulated as to secure for the manufacturers of iron and steel goods further advantages than those proceeding from the conditions already mentioned? There is the loss of metal due to the decarburization and then oxidation of the surfaces of iron and steel due to heating to high temperatures in furnaces where the metal comes into contact with flames, smoke, gas, or other oxidizing atmosphere. Not only is the resulting loss of metal of considerable importance, but the question of decarburization has become of greater consequence owing to the demand for higher standard quality steel. There are, of course, known ways and means of overcoming the decarburization. But they cannot be said to be successful in respect of thermal efficiency, and there are considerable difficulties in securing the necessary conditions.

Professor White and Mr. Hood started on their investigation with an assumption that was drawn from known effects. Heating in illuminating gas alone causes carburization of steel; heating in the ordinary products of combustion causes oxidation. Therefore the deduction that something between these two extremes should be a composition practically neutral in its effect upon steel, and the conclusion that it should be possible to construct a muffle furnace with semi-direct firing, in which a mixture of coal gas with a small amount of air should burn to form a neutral atmosphere, and subsequently burn with more air round the muffle, and so, in this way, largely utilize the thermal value of the gas. The paper introduces us to considerations, the results of step-by-step experiments, and a description of the laboratory furnace devised for securing the conditions of a high temperature, and yet burning a rich mixture of gas and air. In considering the thermal efficiency results, it should, of course, be borne in mind that it should be possible with a larger furnace to get a higher thermal efficiency than with the small laboratory furnace employed, though expectation has always to be qualified by the knowledge of the frequent disappointment experienced in transferring work from the laboratory to the working scale. The coal gas experimented with had a heating value of rather more than 600 B.Th.U.; and, on combining approximately 1 volume of this gas with 2 volumes of air (preheating the mixture), a neutral atmosphere was produced. Although neutral to iron, steel was decarburized slowly at forging temperatures, but nothing like what occurs with the ordinary furnace atmosphere. Such activity as there is may be rendered less by using a mixture still richer in gas. "At the lower temperatures used "in heat treatment, gas of this composition would cease to "exert a decarburizing action." Means are discussed by which the thermal efficiency may be increased.

Subject to the impossibility of speaking too definitely from laboratory experiments, the process appears commercially applicable. The cost of fuel would very probably be higher than under existing methods; but compensation should be more than provided by a considerable saving in metal. Further, if in iron and steel manufacture, decarburization and oxidation can be avoided, this condition would be the precursor of other manufacturing economies. Work of the character that is being carried on at Michigan University should help considerably in establishing town gas still more effectively in iron and steel manufacturing operations.

Artificial Lighting and Deficient Public Knowledge.

WHEN one prominent gas engineer begins to talk in public of doing what is tantamount to handing over in its entirety the lighting business of the gas industry to the electrical industry —although he does not think this likely to occur earlier than a period remote from the present—and setting the gas industry to develop the immense area open for the application of gas to domestic and industrial heating, it is the duty of the remainder of the men of the industry to inquire the wherefore of this manifest lapse in faith, though that prominent gas engineer may stand alone in his view, and may have been totally mistaken in the premises from which he has made his deductions. So far as we gather, the engineer in question has been persuaded to the view he has published from the "housetop" provided by the British Association because he has detected a preference among a certain section of the public for electric lighting, and his opinion is that there would be a larger transfer of lighting custom were it not for the expense of electrical installation. Perhaps there would be; but there would still be a large majority of the public who would use gas, and whose custom is not by any means a negligible quantity. What is there that electric lighting has that gas has not got? The electric light has convenience in switching-on and switching-off; gas has like convenience, but the pilot light is in comparison a disadvantage. Electric-lamps, too, lend themselves to certain decorative effects which gas cannot emulate. But it cannot be admitted that there is any more beauty in electrical fittings than in those for gas lighting. Gas-fittings are procurable in styles as choice as anything that electric light can present; and with the inverted gas-burner, the most exquisite glassware can be used—just as with the electric lamp. The beautiful examples of fittings and glassware seen at the National Gas Exhibition, those at the splendid display made by the South Metropolitan Gas Company at the Ideal Home Exhibition, and those to be seen in every gas show-room that is worthy the name, are testimony to this being so. Then there is the quality of the light. The incandescent gas-light has a much lower intrinsic brilliancy than electric lamps; and the modern forms of the latter multiply this harmful defect many fold. The composition of light and diffusive power are also to the advantage of gas. Quality is something that is important the whole time that artificial light is required; and so is economy. The convenience of being able to light-up and to extinguish lamps without keeping a pilot jet in use is something that is far less important in point of utility than the qualitative properties that are in favour of gas.

When this is the position, and when, despite it, a prominent gas engineer—although alone in his views—gives it as his settled opinion that sooner or later, whether we will

or not, the lighting business will slip from the grasp of the gas industry through a preference on the part of the public, it shows conclusively, if true, that that gas engineer and the gas industry generally are not doing all that should be done to educate the public regarding the scientific aspects of the rival systems of lighting. On more than one occasion, Mr. Jacques Abady has expressed surprise that the gas industry, instead of always talking as though on the defensive in connection with this lighting question, does not take the offensive, in view of the strong support of the qualitative and hygienic attributes of gas lighting. But the gas industry moves along in a curious fashion in this particular matter. It appears, in its propaganda, to consistently follow the lines of least resistance. In domestic and other heating, in water-heating, in cooking, in industrial heating applications, it is in an enviable position—a position that cannot be wrested from it by the electrical competitor. Yet these are the lines that are most assiduously advertised with a view to business development. But business maintenance is equally important; for every consumer lost means that not only has the extent of his business to be recovered elsewhere, but something beyond before it can be said that the business of the undertaking as a whole has developed. And the business that requires most attention, in order to maintain it, is that of lighting—the reason for this being the deplorable ignorance on the part of the public as to the scientific considerations that underlie the subject, which is one of real importance to every individual. It should be the business of the gas industry to see that the public are tutored in these matters—properly and effectively. And, coincidently, it would be well if, in this connection, certain words were borne in mind that were used last week by the Earl of Derby regarding another matter: "No man has "the right to say that any system is a failure unless he has "done *his* best to make it a success."

Mention has been made of the hygienic aspects, in which quality has part. Some time ago an investigation into these aspects was made by Professor von Gruber; and the results were incorporated in a lecture to the German Association of Gas and Water Engineers. These results, as Mr. W. J. A. Butterfield, M.A., F.I.C., has pointed out, in a critical examination of them in our columns [see "JOURNAL" for Sept. 14 and 21], are of a misleading character, and may do untold mischief to the gas industry unless countered. Mr. Butterfield pilloried the learned but egregiously careless von Gruber. He showed how loose and defective were his methods of investigation, and consequently how unacceptable and unworthy of credence the results. Of these use may be made by unscrupulous rivals among the general public, who have no means of examining them aided by the comments thereon of a competent critic. This being so, Mr. Butterfield suggested, at the end of his criticism, that research should be carried out in this country, under properly devised conditions, into this highly important lighting question; and that the results should be translated from the terminology and locution of the laboratory to language that would be understandable by the people, and be distributed broadcast among them. We have at the present time a Ventilation Committee, representing the Institution of Gas Engineers and the Leeds University, through which research into ventilation problems is being conducted. The work of the Committee does not go so far as Mr. Butterfield desires. He counsels chemical and physical investigation of lighting questions under conditions that are ordinary, and not extraordinary through the use of a box-like structure within which research is pursued, and in which ingress and egress of air are regulated, in which there are air-tight window and entrance, and the walls and ceiling of which have nothing in common with the walls and the ceiling of an ordinary room. An investigation on the lines generally defined by Mr. Butterfield is badly wanted. Professor Vivian B. Lewes, Dr. Samuel Rideal, Mr. Otto Hehner, Dr. Leonard Hill, Mr. Butterfield, and many others, have done excellent work, which has contributed largely to our knowledge of the subject. But this work wants co-ordinating by a systematic, detailed investigation under ordinary representative conditions of domestic use, and the results presented in a manner which all would understand.

It was not long ago that Mr. Charles Carpenter, D.Sc., said that lighting is still the backbone of the business of the gas industry; and, this being so, nothing ought to be left undone—from the quality and constancy of gas to the assurance of high efficiency at the burner—to advance and protect the business. Advancement and protection can only be accomplished by going to work the right way—by method, thoroughness, energy, and a full intent to spread complete knowledge among the public on the hygienic and qualitative questions affecting the two illuminants. There is confidence that the gas industry has a good case; then let this confidence be backed up by action, to the end of the preservation of the lighting business.

Tankless Gasholders.

SINCE Mr. William Gadd's spiral-guides relieved gasholders of the necessity of having any external guide-framing, there have been no revolutionary proposals, until lately, for the modification of gasholder construction. The divesting of holders of the outside guide-framing was a big step from conventional methods; but a still larger one would be achieved if there could be deliverance from the holder water-tanks. The most expensive and generally the most critical part of a holder is the tank; and the attendant costs and risks vary with the character of the subsoil and foundation in and upon which the tank is constructed. If tanks could be discarded, then there would be a considerable lightening both of the costs and the risks of holder construction.

An attempt has been made at doing away with the tanks. At various times, our "Register of Patents" in the last volume [commencing with the "JOURNAL" dated Aug. 3] showed this; and the proposal has attracted the attention of technical men both in this country and in America. The invention is a German one; the patentees being the Maschinenfabrik Augsburg-Nürnberg. Quite briefly stated, the holder is simply a plain cylinder, constructed to any size required, without water-tank and guide-framing, or being divided into lifts. Anything that is gas-tight would do for the storage of gas, if that were the only function of the holder. The holder, however, has to give the necessary pressure to provide an adequate supply of gas throughout a district; and this is the principal difficulty in utilizing a rigid structure for storage purposes. In the Nürnberg invention, the cylindrical holder has an inner disc-shaped crown which travels up and down; and round this is a channel for a liquid seal, the depth of which can be regulated to provide the weight for throwing the requisite pressure. The crown is guided by a central column, running on guide-rollers, through the trussing of the roof. The principal difficulty—two patent specifications subsequent to the first one indicate this—is to maintain a tight joint between the water-seal on the disc-shaped dome and the side of the holder. One method, which is described as successful, has been to fit round the sealing part packing strips, and solid material of wedge-shape section, which form sliding pieces. It is clear that the packing must be flexible, so as to follow any deviation in the shape of the wall of the holder, in order to reduce to a minimum the clearance space even when the holder is in action. The escape of water from the seal, under the improved method of packing, is said to be very trifling; and, such as it is, it is caught in an annular channel in the floor of the holder, whence it is pumped back to the feed-tank from which the seal in the moving crown receives compensation. From this it will be seen that there is practically no loss of liquid. Ordinary gas tar, it is stated, has been found suitable for the seal; and it has the advantage that it is quite unnecessary to warm it to prevent freezing in the winter.

The principal doubt rests at the point between the cylindrical shell and the periphery of the travelling dome. We should like to have a good running experience to ascertain that trouble was not going to occur there through leakage of gas to the space above the dome, and undue leakage of water to below it. There is also the question of the effect upon pressure of friction, in the event of even comparatively small deviations from the truth of the cylindrical holder impeding the working of the inner dome. Complaint is made by some hypersensitive persons of the disfigurement of landscapes by present-day telescopic gasholders; and these large cylindrical structures, which would never wholly or partially recede into their tanks as do the telescopic ones, would be a greater eyesore still. But this is only a sentimental disadvantage which must not be allowed to stand in the way of practical utility if the new type of holder justifies itself.

There are obvious advantages in the new invention, if proved trustworthy in working. It appears that there has only been in operation one experimental holder of the new type, and this has been at the Gustavburg works. But one

of 45,000 cubic feet capacity is in course of erection at the Augsburg works—the contract price being the same as that for a holder of the ordinary type of only half the capacity. It is manifest that—with the tank, standards, bracing, and guiding arrangements removed, with all the structural work connected with the telescoping of holders dispensed with, and with the load on the foundations comparatively trifling—the capital cost of such a holder should be relatively low. The holder itself, too, would not be exposed, as are the lifts of an ordinary holder, to the deterioration caused by the immersion of the lifts in the tank water. The cost of upkeep and depreciation should be considerably less than in the case of an ordinary holder; and interest on the capital per unit of capacity would be relatively low. It is plain that in the new type of holder there are numerous advantages. The question is whether reliance can be placed on the structure performing those functions which are indispensable in addition to storage with the regularity that is essential, and which is obtained with holders of ordinary construction. If so, then there will be something for which to thank the Augsburg-Nürnburg Engineering Works; for economy in structure and working parts is as desirable in gasholders as in other structures, providing there is no loss of efficiency.

Coal and Coke Exports.

The Board of Trade returns relating to the shipments of coal and other fuel show that whereas in September, 1913, 6,197,180 tons of coal were exported, in the past month 3,892,033 tons left our shores—being a reduction of 2,305,147 tons. In September last year (the second month of war), 3,859,188 tons were exported; so that upon this figure the exports of last month exhibit an advance of 32,845 tons. The reduction of coal exports during the first year of the war (ending in July) amounted to 29,566,410 tons. Compared with the corresponding periods of 1913, August and September respectively presented reductions of 2,168,690 tons and 2,305,147 tons, or together 4,473,837 tons. In the same two months of last year (when shipping business was considerably upset owing to the declaration of war) the reductions on 1913 were respectively 2,748,420 tons and 2,337,992 tons—together 5,086,412 tons; so that in August and September this year we have exported 612,575 tons more than in those months of last year, though still 4,473,837 tons less than in the same two months of 1913. There is no cause to complain of this increase in exports when we consider that in August France took nearly 1 million tons more than in August last year, and that these are the quantities of her purchases from us in the month of September the last three years: 1,040,489 tons in 1913; 569,667 tons in 1914; 1,687,755 tons in 1915. Bearing on the recent complaints from northern gas undertakings regarding what is considered to be the unnecessary control that is being exercised over gas coke exports, we showed in the "JOURNAL" for Sept. 21 there was an improvement in August in the quantity of business done abroad contrasted with the corresponding period of last year. The coke exports for August, 1913, amounted to 113,423 tons; 1914, to 68,498 tons; and 1915, to 89,574 tons. While September of this year exhibits a considerable improvement on August, the month, compared with last year, is considerably in arrear. The coke exports for September, 1913, reached 125,357 tons; for September, 1914, 130,264 tons; for September, 1915, 108,471 tons.

Coal Exports to Holland.

References have previously been made to this subject, because the gas industry as a large coal consumer is interested in two ways. It is first to its interest that sufficient coal shall be kept at home to adequately supply this country; and, secondly, it is to its interest that the enemy countries shall not be benefited, either by obtaining the excellent quality coal of this country, or by securing for German coal the entire coal trade of neighbouring countries to which they have access. The British gas industry is therefore patriotically and immediately concerned. The information on the subject as given in our columns has been obtained from the "Iron and Coal Trades Review;" and it has shown that the coal trade of Holland is under the supervision of the Kohlenbureau, which is dominated by the Westphalian Coal Syndicate. This is a very undesirable position for more than one reason; and our contemporary appeals to all and sundry interested in the matter to help to bring pressure to bear upon our Government to move in the matter of endeavouring to end the control in Holland of the German Syndicate, which is a detriment to this country. "It is surely," writes our contemporary, "to the interest of everyone in this country, apart from coal exporters and collieries, to see that the Dutch trade is not controlled by the German Syndicate in the way it unquestionably is at the present." Our contemporary supplies information, the validity of which cannot be questioned, that firms in the Netherlands who do business with British collieries, and who refuse to join the Kohlenbureau, are being squeezed out of business. The Kohlenbureau insist that all the details of transactions by firms engaged in Holland in the British coal trade shall be placed in their hands, and thus in the hands of the Westphalian Coal Syndicate. The only object of this can be to cut British coal out of Holland as far as possible, and so create a larger export trade for the Westphalian Coal Syndicate. There is another side to this matter. A correspondent of our contemporary, writing under the *nom de plume* "Shipper," says that shipments are being made to firms in Holland which, although nominally Dutch, are in reality German firms, and in one case at least is under the direct control of the Westphalian Coal Syndicate. In this connection, there is interest in the exports to the Netherlands for September in the past three years: In September, 1913, 154,904 tons were exported to Holland; in September, 1914, 276,031 tons; and in September this year, 174,996 tons. The figure for September, 1914, is especially suspicious. All the evidence supplied by our contemporary indicates that there is an ample case on which our Government could intervene. One thing is certain, that the British coal trade with Holland is at present governed by Germany.

Future Possibilities.

It is a very proper thing to take stock of current conditions, and, by the aid of what is learned from so doing, to consider future possibilities. Many countries will be doing this, in view of their inability to obtain certain things for which they have been accustomed to rely upon Germany and Austria. We are sorry that events compel the incommoding of those countries. But perhaps in the end it will be to their good. The war means that henceforth there is going to be a greater devolution of work, through the necessities of countries. They have been critically examining themselves to see whether they have been making the best use of their own opportunities, and of their capacities for being independent, and are finding out that in several respects there is no reason whatever why certain things made (say) in Germany and Austria need travel to them over sea, inasmuch as they can quite well produce them at home. A Canadian bulletin, on "The Products and Bye-Products of Coal" (from which some interesting extracts are given in this issue of the "JOURNAL"), shows that Canada has been indulging in a little introspection in this regard. Like many other countries, Canada has been importing dyes from Germany; but the volume of their requirements is not thought sufficiently large to encourage the founding of a flourishing dye industry in the Dominion. But in this country, though dyes to the value of millions sterling were imported from Germany, certain firms have done an excellent business in home-produced varieties, with an annual value of not more than (say) three-quarters of a million. It paid them; it is paying this country now to expand its producing capacity. Why should not Canada make a start, or is the business smaller than warrants even a beginning? We have no data on the subject to guide to an opinion. However, dyes are not the only things produced from tar. There are other products of great commercial value; and the bulletin points out that they are peculiarly suitable for production in Canada. Taking up this work would render the Dominion independent of foreign sources of supply. "Necessity" is not only the "mother of invention," but of commercial enterprise. So we may expect to see various overseas countries internally developing industrially by supplies from Germany and Austria being cut off. If this happens, those countries will have gained some benefit from the war.

Society of British Gas Industries.—The autumn general meeting of the Society will take place at the Trocadero Restaurant on Thursday, Nov. 4, when a short report on the work of the Society during the past six months will be given by the Chairman of the Council (Alderman F. Templer Depree, J.P., of Exeter). This will be followed by a discussion. Afterwards there will be afternoon tea, by invitation of the Chairman of the Council. In consequence of the war, the usual dinner will be dispensed with.

BRITISH ASSOCIATION COMMITTEE ON FUEL ECONOMY.

As an outcome of the recent Manchester meeting, the British Association have invited a number of gentlemen to serve on a Committee to consider and report upon the question of Fuel Economy (Utilization of Coal and Smoke Prevention). The function of the Committee is to consider the whole question of fuel economy and the better utilization of coal from a broad and national standpoint, in order to urge upon the Government and the community generally at this juncture the need of systematic scientific control of fuel consumption on public lines as a direction in which large national economies can be most healthfully and advantageously realized in the immediate future. This matter has already been the subject of discussion in our Editorial columns, and further reference is made to it to-day.

It will be seen from the following names of gentlemen who have been invited to serve that the Committee [which is empowered to add, if necessary, to its members] has been selected so as to include representative chemists, engineers, and technologists from all the principal industrial areas.

Professor WILLIAM A. BONE, F.R.S., Imperial College of Science and Technology, London (*Chairman*).
Mr. E. D. SIMON, Chairman of the Manchester Air Pollution Committee (*Secretary*).
Professor P. P. BEDSON, Armstrong College, Newcastle-on-Tyne).
Professors J. W. COBB and J. B. COHEN, F.R.S., Leeds University.
Professor H. B. DIXON, F.R.S., Manchester University.
Professer THOMAS GRAY, Royal Technical College, Glasgow.
Professor H. S. HELE-SHAW, F.R.S., London.
Professors L. T. O'SHEA and W. P. WYNNE, F.R.S., Sheffield University.
Professor RICHARD THRELFALL, F.R.S., Birmingham.
Dr. G. T. BEILBY, F.R.S., Glasgow.
Mr. ERNEST BURY and Dr. J. E. STEAD, F.R.S., Middlesbrough and the Cleveland District.

PERSONAL.

Mr. ALBERT NORTH, foreman at the Ossett Corporation Gas-Works, has been appointed Manager of the Rugeley (Staffordshire) Gas-Works. His new charge supplies a population of about 6000 people and provides for a consumption of some 20 million cubic feet of gas per year.

Corporal JOHN HOLLIDAY (formerly Gas Engineer at Scarborough, and later at Hull), who joined the Royal Engineers in February as a sapper, and after four months' training at Buxton with the 141st Fortress Company was transferred to the Chemical Section, is, to use his own words, "knocked out for the time being;" and we trust it will only be a short time. He is back from France, and in the American War Hospital at Paignton.

The issue of "Het Gas" for the 1st inst. reports that on Sept. 1 Heer J. H. FRANKEN celebrated the completion of forty years' association with the gas industry—he having entered the service of the Corporation gas undertaking of The Hague on Sept. 1, 1875. During 1883, he became Assistant-Engineer at the Amsterdam works of the Imperial Continental Gas Association; and when the works were taken over by the Municipality in 1898, he was transferred to the staff of the Association's Antwerp works, to which he is still attached.

Sergeant CHARLES VALON, of the Leicestershire Yeomanry, who was wounded last February in a manner which resulted in temporary paralysis of the arms and legs, is, we are glad to hear, making some progress towards recovery, though it is only very slow. He has to some extent recovered the use of his limbs, and, what is perhaps even better, is now convinced that he is going to make a complete recovery. When the war broke out, he had resigned a position under Mr. Hubert Pooley at Leicester, to take up an appointment at the Bath Gas-Works. Mr. JACK VALON, who was engaged at the Singapore Municipal Gas-Works, has been given a Commission in the Royal Sussex Regiment. He is not yet in France, but may be going at any moment.

OBITUARY.

The death has taken place at Saltburn of Mr. WILLIAM I'ANSON, Assoc.M.Inst.C.E., who for nearly fifty years occupied the position of Secretary and Engineer of the Cleveland Water Company. The deceased was 68 years old, and was a native of Richmond.

In "Het Gas" for the 1st inst. there was a report of the death on Sept. 22 of Heer C. J. VAN DER PLANK, the Manager of the Assen Gas-Works. Deceased was son of the Manager of the Amersfoort Gas-Works, where he had acted as Assistant-Manager for four years—becoming in 1898 the Manager of the Zalt-Bommel Gas-Works, which position he vacated in 1901 to take up the managership at Assen. Heer van der Plank was only 44 years old.

THE INTERNATIONAL GAS CONGRESS AT SAN FRANCISCO.

By ARTHUR H. ELLIOTT, Ph.D., M.S.

SAN FRANCISCO, *Sept.* 25, 1915.

IT is very difficult to realize how well our California friends have anticipated, and bounteously provided for, the advent of the International Gas Congress, and the meetings of the American Gas Institute and the Pacific Coast Gas Association. The leading spirit is very dominant; and his executive ability and bigheartedness are seen everywhere. Mr. E. C. Jones, the genial Chief Engineer of the Gas Department of the Pacific Gas and Electric Company, is a sterling character; and everything echoes with his cry of "Have a good time in San Francisco." This does not mean mere trifling fun, but earnest purpose and profit, with hearty good nature and a keen eye to progress.

The provisions for service to the visiting officers of the Congress and Institute have been more than generous; the ample offices at the "Hall of the Native Sons" speaks volumes as you arrive to register and get programmes and literature. The kindness and willingness to help visiting brother gas engineers are evident, turn where you will; each appears to emulate his fellows to show *bon camaraderie*.

New York, Chicago, and the East have sent about 120 men, which, considering the distance—2000 to 3000 miles—is a very fine showing of attendance. Even Sunny Honolulu sends delegates to participate in this Congress of men of light and energy. California's sons are here in great numbers, and full of the spirit of welcome; making a total of about 500 men and many ladies. When we consider that this city was a pile of burning ashes only nine years ago, what we see now seems almost beyond belief; while we note that there is scarcely a trace of the devastation left which almost paralyzed its people at that time. Now we see handsome stores, shops, and office buildings; magnificent hotels, second to none in the Eastern States or Europe; handsome residences perched picturesquely along the hillsides. We can only wonder what titans have been working these achievements in steel, stone, and concrete; to the building of a San Francisco that must be a model city for future generations to admire, and to stimulate the hearts to the promotion of the spirit of the Golden West.

San Francisco is a city of about 550,000 people under normal conditions, but now crowded with humanity to the extent of about 800,000. Its handsome wide streets, its thousands of automobiles, its brilliantly lighted avenues and roads, its splendid electric trolley and bus service, all point to a future not now dreamed of; making it another New York on the Pacific Coast. It is already beginning to feel the opening of the Panama Canal; and ships from France and Italy and many other European ports, steaming through the cut in the isthmus, are seen loading and unloading at San Francisco wharves. The balmy and refreshing air of the city, not hot or cold, almost always sunny, gives vigour to men not to be found anywhere else in the United States. There is a tang to the air that must be felt; it cannot be described in words or on paper.

This marvellous exposition, built with an expenditure of fifty millions of dollars, and even now paid for, yet has to Dec. 4 to run, is beyond description on paper. The architect, the painter, and the men of stone and concrete have vied with one another to see who could best fulfil the spirit of California in that galaxy of flowers, form, and sunshine that carries one beyond earth to some paradise pictured, but almost not to be realized. And yet it is here. In daytime the vistas of beauty in travertine-like walls, with columns and pilasters of terra-cotta, rich with details that some artist has breathed his soul into, to give impressions beautiful in form and figure, are most harmonious, and carried to heights of 80 to 100 feet. Walls also are seen, formed of creeping plants, towering 15 or 20 feet, and begemmed with flowers of purple, blue, and red. Against such backgrounds statues in marble, bronze, and terra-cotta, telling stories of life in every phase, from sweet childhood to old age, hold the observer fairly transfixed with their beauty and the joy of harmony.

When night falls, and the shadows give the buildings that hazy hue where twilight calls to rest, we see peeping lights begin to dot the scene, and, light after light appearing, there opens up another revelry of beauty, due to another band of artists—the men of light and illumination. Then, as darkness deepens, the joyous display of light and colour transforms the buildings, towers, and spires into a fantastic beauty that must be seen—no pen can describe it. It is very doubtful whether anything like this can be surpassed. It is due to the genius and broad ideas of Mr. W. D'A. Ryan, the illuminating engineer whose brain conceived and carried out these colossal effects. By a combination of gas and electrical illumination never before attempted, and where each supports and amplifies the other, he has produced at night a scene so beautiful that it is hard to choose between it and the beauties of daylight and sunshine.

This is the environment of those who see San Francisco now. Its men and women are as bright as the scenes they have created. If the world would only forget war, and come to California, Mars would be banished for ever, and "Peace on Earth Good Will to Men" the only motto on a banner leading all nations. The picture attempted above is of men and things that are virile with California life, and some of the moving spirits should now be noted.

Since we are here to take notice of the development of gas, we must not forget the man who has transformed gas manufacture in California, and perhaps the world over—Edward C. Jones. Harking back some thirty or more years ago, we see a band of men with William H. Bradley, the veteran Chief Engineer of the New York Gas-Works, struggling with water gas, and pulling out of a tangle of methods the process of Tessié du Motay, the first practical means to serve any large city with water gas lighting. This story has been told many times; and its chief engineer has lived to see yet another epoch dawn like the one to which he then pointed the way—*i.e.*, the development of oil gas in California.

It must be remembered that a little spark from Bradley's torch dropped on E. C. Jones, of San Francisco, about thirty-five years ago, when he visited the veteran chief in the works at New York. This spark continued to hold out to burn until the moment when, in the Golden West, Edward C. Jones faced the problem of making gas with expensive coal and cheap oil. Now, after many years of toil, he has evolved a method using oil only and steam, where, in a set of generators, of about 18 feet in diameter and 45 and 65 feet high, he can produce daily an output of 12 million cubic feet of finished gas. Not a pound of coal is used to do the work. The oil has a density of 19° Bé., and the gas a calorific value of about 650 B.Th.U.

Nothing in words can describe this new achievement in gas manufacture. A generator house free from coal and its incidental dust and dirt, clean almost as a modern, well-kept engine room, with a working floor and neat tables for records of runs and data of manufacturing as tidy as an office, is certainly novel as seen in the manufacture of oil water gas. No one can conceive a gas-works so clean until he sees this outfit. There is nothing to make it dirty.

Next Monday the sessions of the Pacific Coast Gas Association and the American Gas Institute, as well as those of the International Gas Congress, begin. Everybody seems ready to take an active part in them; and there are a goodly number of papers on technical as well as commercial subjects.

No trouble has been spared by the men in charge to make everything run smoothly, and success is assured; the success now being enjoyed and expected by the men of California.

ELECTRICITY SUPPLY MEMORANDA.

It is so rare that the electrical people get hold of a man in the front position in the gas profession to say anything they can put to practical use in developing their own business, that they find it difficult to drop Mr. J. G. Newbigging's British Association paper, and the solitary attitude he took up regarding the competition for lighting where supplies of gas and electricity are in the possession of a municipal authority. What Mr. Newbigging said in his paper was so absolutely in accord with what our electrical friends wanted, that they were almost beside themselves with joy when he made in the "Correspondence" columns of our issue for Sept. 28, reaffirmation of his views, but adding something which our electrical friends do not approve of, judging by their silence. The ignored point is that Mr. Newbigging infers that his considered opinion is that it is "A long, long way to Tipperary"—in other words, that what he, as a prophet, has prognosticated will not come to pass until very far in the future. There is personal safety in this attitude, because it gives one plenty of latitude, which may mean anything from a few years until after that time when matters of the kind will not be the subject of meditation, and will not disturb our peace in the least. The "Electrical Times" heads its latest reference to Mr. Newbigging's opinions on this matter with the interrogation, "Is it a Dream?" And it cannot get further than hypothesis, and the support of Mr. Newbigging and Mr. F. D. Marshall [see also our "Correspondence" columns for Sept. 28] in what follows from the pen of "Meteor," so that there is not much to help us there. "Electrical Industries" designates Mr. Newbigging "The Honest Heretic."

A Friend in Need.

The first-named paper finds that our Manchester friend has passed from an attitude of philosophic doubt to one of open commendation of the electric light. And, gleefully, it remarks: "Ten years ago—nay even five years ago—who would have dreamed such a thing would be possible?" As to Mr. Marshall, the paper proceeds to say: "Later on, perhaps, the gas men and the electrical engineers may become the best of friends on the lines indicated by Mr. Marshall. But not until circumstances have inevitably forced the contest for domestic heating and cooking to a similar decision. That process will not be beneficial for the disputants; but while human nature remains what it is, this destructive competition for the aggrandisement of an indifferent public must be carried to its only logical conclusion." The "perhaps" is indefinite. The "similar decision," and the "only logical conclusion" are indications of a hope which, read in conjunction with the headline "Is it a Dream?" is permeated with much doubt. In fact, "Meteor" does not let his readers see all that is contained in the covert recesses of his mind. If he did, it would most probably be found that the notion of gobbling-up the whole of the business of the gas industry, and then making the professional gas man a sort of engineer-in-charge of the plant producing gas for electric generation, and of that required for the development of the residual products of carbonization, is regarded by him as having as much prospect of realization as that he will some day be the tenant of a castle in the air. Of course, he knows very well, although not permitted to proclaim the fact, that such an idiotic thing will not occur as the supplanting of a cheap heating agent by an extraordinarily expensive one, with the view of promoting further uneconomy in the world. If we were asked to guess what is likely to happen in this connection in the future, we should give reply that gas will be the general fuel, and that the trading in it will be of such huge volume that the lighting business will be nothing more than a pendant of the main business. So many industries and the very security of the country are dependent upon the products of the carbonization of coal, that carbonized it must be. The enlargement of the gas-heating business will develop the cheap supply of the products that these industries and the country require. The development of the gas industry, the processes of which are fundamental ones, should tend to cheapness. Then why should not electricity become a sort of bye-product of the gas industry. There is more sense in suggesting this than in anticipating complete absorption of the gas industry's business by the electricity industry, and the conversion of the gas industry into something merely ancillary to the generation of electricity.

Dreams.

"Electrical Industries," on the same subject, opines that in time the "Journal" will realize that "what Mr. Newbigging said yesterday, the world said the day before." We should have been very deaf if we had not heard what the world said the day before Mr. Newbigging spoke. Only if the world had previously decided the respective destinies of gas and electric lighting, why is it so long acting upon its decision? There must be reasons; and the reasons that have been deterrent up to the present are still strong. What the world said and how it acted seem to be in opposition. If our friend is right, then the lighting business of the gas industry ought to have collapsed ere this, whereas we cannot avoid the facts that the business of the gas industry, after daylight hours, is as large to-day—despite the economy of incandescent gas lighting and the competition of electric lighting—as the total business of the industry when electricity first entered the public service; and that since that time the volume of the industry's business has about doubled, giving to the daylight hours a business the equivalent of the total possessed in the early eighties. These are facts that the scribes and prophets—comic and otherwise, mostly the former—of the electricity industry avoid as much as possible. "Electrical Industries" smiles at our contention that the quality of gas light is superior to that of electric light, regarded from the standpoints of intrinsic brilliancy and composition. But there is no categorical denial of our statements; only the usual sloppy electrical plan of getting over ugly, rough places by treating them as though unworthy of serious notice.

What the World Said, and How it Acted.

The same day that our contemporary published its superficial remarks on the question of the quality of the two lights, a circular was forwarded to the writer of "Electricity Supply Memoranda" which has been widely distributed by a firm of surgeons' opticians carrying on business in the West-end. This is the opening paragraph of the circular:

A Spectacled Race.

> When one complains of the eyes feeling weary and sore, there is little doubt that the cause is generally due to the chemical and heat rays which are given off in great quantities by the present-day electric lights. These rays which are technically known as "ultra-violet" or chemical rays, and "infra-red" or heat rays, have the effect of causing electric ophthalmia. Where electric light is habitually used for reading, it is quite obvious that the harmful rays given off from it and reflected into the eyes from the white paper, must cause a great amount of harm. Experiments on both human and animal's eyes have proved that electric ophthalmia *is entirely due to the ultra-violet rays emitted from electric light.* More important still, it has been shown that electric ophthalmia is often but a stepping-stone to cataract. Therefore, the need to counteract the harmful rays by the most practicable and least uncomfortable means is of vital necessity.

Then the circular goes on to allude to the experiments made by Sir William Crookes, which resulted in the production of a new ophthalmic glass, which "resists all the harmful ultra-violet and infra-red rays." Again: "Eventually two kinds of glass were developed . . suitable for ophthalmic use, and both of which combined in the highest degree the ability to cut out both the heat and the chemical rays without at all interfering with the visible light.

> The first (*a*) is a very pale amethyst colour, so pale, indeed, as to appear almost colourless when fitted in spectacles or pince-nez. The second (*b*) is a medium neutral tint designed to cut down the glare as well as to absorb the harmful rays. To describe the scientific properties in terms of every day experience, we say that, when the (*a*) shade of Crookes glass is used, objects appear as usual in their natural colours, but the eyes are entirely shielded from the dangerous chemical rays and nearly half of the heat rays. When the dark or (*b*) shade of glass is used, objects still retain all their natural colours, but all glare is removed, besides the harmful rays. . . . The (*a*) tint is recommended for general wear, being to all appearances just

like a colourless lens; and also, for reading by electric light, *even when reading glasses are not usually needed, to safeguard the eyes from electric ophthalmia.* The smoke or (*b*) lenses should be used for sheltering the eyes from excessive visible rays.

So what it comes to is that the electric light is so noxious to eyesight that, in its presence, glasses ought to be worn to protect the eyes from its malign influences. Nature surely never contemplated that we should all be compelled to use protectors to vision in order to permit the employment of a light which (without that protection) deteriorates eyesight. Fancy seeing, everywhere we went, nothing but spectacled people! That is more than can be endured even to give the electric light universal use by displacing lighting agents that are less harmful to the eyes.

Small Talk in the "Electrician."

In the "Commercial and Industrial Section" of the "Electrician," there is a paragraph headed "Gas and the War." The writer of the paragraph has been "reminded" by an attractive pamphlet issued by the Gas Light and Coke Company that gas is having a constructive, as well as a destructive, influence on the war. So far no objection—not even to the acknowledgment of a little forgetfulness that the gas industry is taking more than ever to-day a very important part in national affairs, and thereby is disseminating the information among manufacturers that gas is an important agent for them in accelerating and increasing production, as well as in improving quality by the ability to quickly obtain requisite temperatures, temperature uniformity, and temperature adjustability. This has nothing to do with the important position that the gas industry also occupies as the provider of raw materials for other industries. But the "Electrician" writer goes on to observe: "We do not often refer to publications emanating from this source, *let alone to speak approvingly of them.*" This suggests prejudgment; and a cherished but mistaken idea that nothing good can come out of Horseferry Road. Then there is an indication that the paragraph was penned by the office boy, for we read: "The war has raised *even* gas to the level of electricity." The war could do nothing of the kind. Gas has never admitted that in utility as a domestic and industrial agent, it was at such a low level as electricity. In traction, it has never seriously vied with electrical energy; but in other applications, it takes anything but second place. Before the war gas possessed undeveloped potentiality, and the war has supplied the opportunity for proving this promptly and to an extent which, in the ordinary course of things, would have taken some years of propaganda work to effect. From manufacturers, for example, orders—some of them valued at four figures—for gas-furnaces, large and small, have been sent in without canvassing. A new era has set in for gas in industrial heating; and the gas industry will henceforth from the circulated knowledge reap benefit in increasing volume year by year. Was it not in the "Electrician" supplement that someone went into ecstasies only a short time since over the supersession of gas by electricity for heating dies in some small operation, where there had been use of gas in a manner that evidently was not in the best form—that is to say, judging from the statements made in our contemporary?

The Point-Five Tariff.

The writer of the article on the "Point-Five Tariff" in the "Electrical Review" has given the second instalment, which shows further how deficient is rateable value as a basis for the fixed charge. He gives the following as an example: A consumer subjected to 12½ per cent. fixed charge on £50 rateable value and charged ½d. a unit. for all consumption, would have his total liability fixed on the following scale:

Consumption per Annum.	Energy Charge.	Total Charge.	Mean Price per Unit.
500 units ..	250d. ..	1750d. ..	3·5d.
1000 „ ..	500 ..	2000 ..	2·0
1500 „ ..	750 ..	2250 ..	1·5
2500 „ ..	1250 ..	2750 ..	1·1
5000 „ ..	2500 ..	4000 ..	0·8

This table shows that although the consumption of extra units increases the total bill but slowly, it reduces the mean price per unit rapidly. If a consumer chooses to consume more energy without exceeding a certain maximum demand, there is every reason why he should receive his whole supply at an appreciably lower average price; but there is no justification for charging Messrs. A, B, and C at the average rate of 1·1d., 1·5d., and 1·9d. per unit respectively for equal annual consumption of 1500 units in each case, just because they live in houses assessed at £30, £50, and £70 respectively. The writer asserts that the rateable value tariff must already be responsible for many grave anomalies between the current consumption and the bills of individual consumers; and such anomalies cannot be good for the industry as a whole. He concludes that a rational system would be to make the fixed charge depend entirely on the maximum demand.

Facilities for the study of designing in steel-work and reinforced concrete are provided on Thursday evenings at the London County Council's School of Building, Ferndale Road, Brixton. The advances made in structural engineering, and the London County Council's new regulations for reinforced concrete, have created a growing demand for young engineers and architects with practical training in the theory and design of structures. The class is conducted by Mr. R. Graham Keevill, A.M.I.M.E.

WORKMEN'S COMPENSATION STATISTICS.

WHAT is presumably an effect of the recent conclusions as to the advisability of economizing on the production of periodical Government publications, is to be seen in the annual statistics regarding the Workmen's Compensation Act, 1906, and the Employers' Liability Act, 1880, which, "in consequence of the war," have just appeared, for the year 1914, in the form of a sixteen-page White Paper, instead of, as formerly, in the shape of a Blue-Book running to sixty and more pages.

In connection with the operation of the Compensation Act, particulars have again been prepared of what has occurred in the twelve months under review in the seven great groups of industries—mines, quarries, railways, factories, harbours and docks, constructional works, and shipping. The number of employers from whom returns were received in these seven groups of industries was 129,925; while the aggregate number of persons who came within the provisions of the Act as being employed in the industries was rather more than 7 millions—a falling-off of about half-a-million as compared with the previous year being, no doubt correctly, attributed to the large number of men who joined the Colours in the latter part of the year. During 1914, compensation was paid in 4216 cases of death, and 437,900 cases of disablement; the payments for compensation amounting to £679,732 for fatal accidents, and £2,785,629 for non-fatal ones. It is pointed out that, notwithstanding the disorganization of industry caused by the outbreak of war during the last half of the year, the total amount of compensation [£3,465,361] shows an increase over the figure [£3,361,650] for the preceding year. This is mainly due to payments in respect of the Senghenydd colliery disaster, in which 440 lives were lost, and to the growing accumulation of long-standing cases in which the payments are continued from year to year. As a matter of fact, a comparison of the present figures with those of previous years shows that in these groups of industries there has since the passing of the Act been a steady increase both in the number of cases in which compensation has been paid, and in the actual amount of compensation. In 1909, for instance, there were 335,953 accidents, in respect of which £2,274,238 was paid. It is calculated that, including the costs of management, commission, legal, and medical expenses, the total charge of the Act upon the seven industries named was not less last year than the £5,000,000 at which it was estimated for 1913.

Over the whole of the industries, the annual charge for compensation per person employed averaged 9s. 9d. for 1914, as compared with 8s. 11d. in the year before. Factories occupy the best position in the list, with 5s. 2d. per person; mines being heaviest with 28s. 7d. In connection with quarries, the charge was 11s. 5d., and for constructional work 14s. 11d. There are included in the figures given, in addition to accidents, cases of the various industrial diseases which come within the range of the Compensation Act. In the seven groups of industries compensation was paid in 43 fatal cases to the amount of £7099, and in 9622 disablement cases to the amount of £182,551. No less than 92·4 per cent. of these industrial disease cases occurred in connection with the mining industry; while of the remainder, 544 were cases of lead poisoning.

Glancing at the figures relating to accidents in mines, it is seen that the total number of persons employed last year was 1,046,357, of whom 6299 were females. There were 1768 fatal accidents, and 179,899 cases of disablement. The compensation paid in respect of the former was £307,035, and of the latter £1,024,054. In connection with industrial diseases, there were no fatal cases; but 8928 cases of disablement occurred, involving payment of £164,833. Adding these figures together, a total is arrived at as the compensation paid in the mining industry during the twelve months of 1914 of £1,495,922, as compared with £1,351,258 for the preceding year.

From a table which is given with regard to the duration of compensation for accidents, it is gathered that during last year the cases lasting two weeks and less than three weeks accounted for 32·94 per cent. of the total number; and those lasting four weeks and less than thirteen weeks, for 34·28 per cent. No more than about 1½ per cent. of the cases lasted 26 weeks and over. Cases terminated by payment of a lump sum are not taken into account in these calculations. They are usually in regard to accidents in which the disablement is likely to last for a considerable period; so that by their inclusion the proportion of long duration cases would be increased.

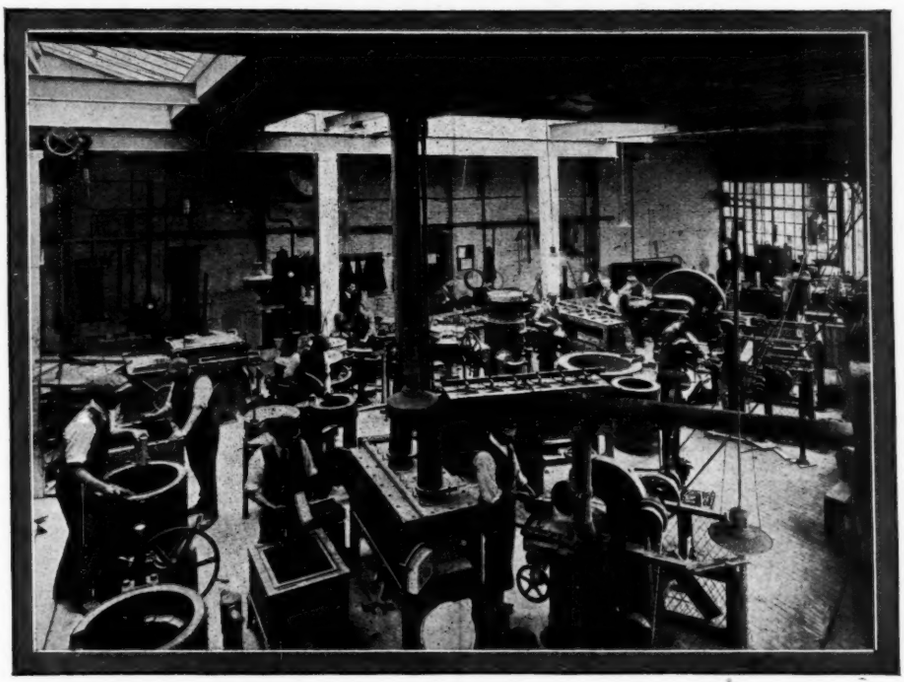
The statistics in Part II. of the report relate to proceedings in the Courts. These show that the number of cases under the Compensation Act which were taken into Court in 1914 was 9746. Some of these, however, were for dealing with allowances already granted, and many were settled out of Court or otherwise disposed of; so that the total number of original claims for compensation finally settled in Court was only 5531—80 per cent. of which were decided in favour of the applicant. The total number of cases under the Employers' Liability Act taken into Court in the whole of the United Kingdom was 139. The figures have been steadily diminishing since 1907, when the number of cases was 604. As is remarked in the report, this condition of affairs clearly indicates the tendency of the remedy that was provided by the older Act to fall into disuse since the Compensation Act of 1906 came into full operation.

GAS APPARATUS FOR MUNITION WORK.

A STRIKING object-lesson regarding the very large amount of gas apparatus that is being steadily called for to carry on munition work throughout the country, is afforded by the accompanying photographs, just taken, of two of the shops in the Furnace Department of Messrs. John Wright and Co., of Birmingham.

No. 1 furnace-shop is used principally for erecting special apparatus; and it is crowded with every variety of gas apparatus for munition work. Among the various furnaces in course of erection may be seen two nosing furnaces for 5-inch shells, two rotary furnaces for heating open ends of 3·3-inch shells, four rotary furnaces for annealing fuse parts before stamping, three tilting furnaces for melting aluminium for fuse parts, &c., a patent crucible furnace for melting copper and brass alloys, a double-ended oven furnace for heating steel billets, a large gas-heated pan for use in connection with the filling of high-explosive shells, an oil-bath for tempering automatic-machine tools, and a tool forge.

The No. 2, or "Holborn Hill," Furnace-Shop, as will be seen, is used for putting together the very large types of gas-furnaces. The photograph shows a considerable number of standard oven-furnaces in course of erection, one of these being 12 feet in length. Many of these furnaces have been supplied to large engineering firms for annealing brass strip and rod metal, cartridge clips, &c.



INTERIOR OF ONE END OF No. 1 FURNACE-SHOP.

THE No. 2, OR "HOLBORN HILL" FURNACE-SHOP.

Coal and Coke Exports.—The War Trade Department announce that, in order to prevent speculative applications for licences for the export of coal and coke, it will be necessary, on and after Nov. 1, for each application for a licence to be accompanied by a declaration to the effect that the proposed shipment is in pursuance of an existing contract, or in execution of a definite order for coal or coke. A revised form of application is now in course of preparation, and will contain the declaration required.

THE BERLIN CITY GAS-WORKS AND THE SUPPLY OF COKE.

The situation of the Berlin City Gas-Works was referred to at some length in a communication published in the columns of one of the principal German commercial newspapers, "from a correspondent in the German capital."

It appears from a discussion which has arisen in the city that apprehensions had been entertained that difficulties would be encountered in the supply of coke to the public during the ensuing winter, because the city gas-works will only be able to maintain their deliveries of coke to a very limited extent as compared with former winters. It was, however, obvious, the correspondent remarks, that these obstacles could easily be overcome, as there is no question of any scarcity of coal or coke in Germany—especially as the country is said to be able to furnish considerable quantities to neutral nations. As a matter of fact, the difficulties resulting from the restricted deliveries of coke from the city gas-works have been promptly removed. The Government Mines Administration has published a notice showing that any anxiety respecting the supply of coke in Berlin no longer exists. The negotiations which have taken place at the Ministry of Commerce, which controls the particular collieries owned by the State, have led to the result that the Coal Syndicate of Lower Silesia, the coke-works in Upper Silesia, and the Rhenish-Westphalian Coal Syndicate have undertaken to meet the deficiency incidental to the supplies from the city gas-works. The deliveries will take place at the proper time, as all the interested Syndicates have expressed their readiness to instruct their organizations to arrange for adequate supplies being furnished to Berlin merchants.

It will be noticed that the settlement of the question is not proposed to be effected in the way of the delivery of suitable coal to the gas-works so that the latter would be able to supply the public with coke in the customary manner, but that the gas-works are being passed over by the intention of the Mining Syndicates to deliver coke direct to the merchants. It seems, in fact, the correspondent proceeds to state, that it is proposed not only to deal with the Berlin city gas-works in this manner, but, according to a declaration made by another Berlin newspaper, a number of other German towns are in a similar situation. There is no possible doubt as to the foundation of this intention. During periods of peace the Berlin gas-works, and a large number of other gas-works, have bought considerable quantities of English coal; and they are now to be penalized for having done so. These works have by no means exclusively used English coal, but have also carbonized, besides German, English coal only so far as was required, having regard to recognized commercial principles and to the interests of the ratepayers in times of peace. That this practice was followed was only right and their duty; for in those districts where the freight conditions rendered possible the competition of English coal, the latter was the most important price regulator in the German market. [This argument was used frequently in former years by the "Berliner Tageblatt."] The drawing upon supplies of English coal by consumers in partly meeting their requirements had the effect, where such deliveries were possible, of removing the price monopoly of the German Syndicates, and compelled them to accommodate their prices to those of their foreign competitors, in the same way as they did in the markets of the world.

A few years ago the German gas-works declared that it was precisely this competition which afforded them important protection against the excessive prices which were demanded by the State mining administration in the district of the Saar, where the Government mines produce about 12,000,000 tons of coal per annum. It goes without saying that this competition has constantly been a thorn in the eyes of the German coal producers. But this circumstance does not justify the way in which they are now taking advantage of the condition of war in order to punish the former customers for English coal.

The correspondent further remarks that the Berlin city gas-works are greatly restricted in obtaining supplies of coal—being compelled to make purchases in Moravia, Bohemia, and Poland of coal whose yield of coke is inadequate for the purpose. And while the works are procuring no serviceable coal, the great Syndicates, instead of furnishing them with coal, take away from them the trade in coke, which is naturally a very favourable business to the coal producers in consequence of the considerable profits realized from the make of coke and the extraction of the bye-products. It is obviously desired in this way to compel the gas-works to, in the future, entirely exclude English coal, and to limit their supplies to native coal. The amount saved by the Berlin city gas-works in times of peace through the buying of English coal is now to be lost four times over by irrational working with unsuitable coal—a fact which represents, the correspondent concludes, a salutary lesson which serves as a warning for the period after the conclusion of peace.

The Council of the Society of Arts announce that, until further notice, the hour for the ordinary Wednesday meetings and for the Cantor Lectures will be 4.30 p.m., instead of 8 p.m. This change has been made to meet the convenience of fellows owing to the darkening of the streets at night.

MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

Autumn Meeting at Birmingham.

The Autumn General Meeting of the Association was held on Thursday last, at the Grand Hotel, Birmingham. Mr. W. J. Rendell Baker, of Mansfield, the President, occupied the chair.

Losses by Death.

Sympathy was expressed with the families of the late Mr. W. Langford, of Stoke-on-Trent, and the late Mr. Edward Allen.

Mr. J. Ferguson Bell (Derby) said Mr. Langford was a leading engineer in the Midlands, and was well known. He took an active interest in the Association. He was very approachable; and when he made a statement they could always rely that it represented the facts. Mr. Allen's loss to the gas industry was an irreparable one. It was only a few months since he visited the Midlands; and they all saw him then. He was in the very best of health; and they looked forward to many years' service on Mr. Allen's part. He was always accessible to members of the industry, readily giving advice and assistance. His death must have been a great blow, not only to the Midlands, but all over the country.

Mr. Hubert Pooley and Mr. A. T. Harris having spoken in similar terms, a vote of sympathy with the relatives of the deceased gentlemen was passed. It was explained that letters expressing the feelings of members had already been sent to Mrs. Langford and Mrs. Allen. In these circumstances, the meeting decided that the vote should be recorded on the minutes.

Election of Officers.

The Secretary (Mr. W. G. S. Cranmer) explained that the Committee submitted the following nominations for vacancies on the Committee, and also for various offices:—

President: Mr. C. H. Webb, Stourbridge.
Vice-President: Mr. George Stevenson, Long Eaton.
Hon. Treasurer: Mr. W. R. Cooper, Banbury.
Hon. Secretary: Mr. W. G. S. Cranmer, Willenhall.
Auditors: Mr. B. Ely, Pye Bridge, and Mr. F. L. Wimhurst, Newcastle, Staffs.
New Members of Committee: Messrs. J. Brettle, R. H. Ainsworth, W. Chaney, and B. W. Smith.

The Secretary added that there were no further nominations; and he took it that the gentlemen he had named automatically became the officials for the next twelve months. Personally, he would much rather have seen a number of members nominated for the positions by the ordinary members of the Association. He thought the complaint of secretaries for some years past had been that nominations had not been made in this way, but that they had always been left more or less to the Committee. Some little time ago, they would remember, there were several discussions on the question of the election of officials; and the rules were altered with the idea of giving members more power in this direction. Unfortunately, use had not been made of these opportunities.

Mr. W. C. Jones (Brierley Hill) proposed that the recommendations of the Committee be accepted. He advanced as a reason why no nominations had been received from the general body of members that the selections made by the Committee recently, and especially during the abnormal war conditions, had met with the approval of the members generally.

Mr. Ferguson Bell, in seconding the motion, congratulated Mr. Webb upon his appointment as President. He agreed with Mr. Jones that the absence of nominations proved that the members were well satisfied with the appointments suggested. They had always been fortunate with their selection of the Association's officers, and he was very glad to find that some of the older members were taking a lead in the Association.

New Members.

The following new members were elected: Messrs. Reginald Thomas, of Droitwich, William Prince, of Tipton, and George Hinson, of Chipping Norton.

Gas-Fitters' Certificates.

The Secretary said he had a number of applications for certificates sent in by various members on behalf of fitters in their employ. They were, however, only a very small proportion of the number of forms he had sent out to members—at their request, of course. If those who had forms ready filled in would let him have them as soon as possible, he would send them on to Mr. Dunn for consideration by the Committee in London.

A Member inquired whether anything had been done in different parts of the country towards getting certificates for working gas-fitters employed by master plumbers and others, and who were not connected with the gas undertaking of the town—particularly in towns like Birmingham and Burton-on-Trent, where the gas-fitters worked to some extent under the direction of the gas undertaking.

The President pointed out that any application from a local plumber would have to come through the local gas engineer.

Home Sales of Sulphate of Ammonia.

Mr. A. G. Leighton, of the Sulphate of Ammonia Association, then read a paper which was on the lines of that contributed by Mr. F. C. O. Speyer to the North British Association last month. [See "Journal" for Sept. 7, p. 512.] In the course of the discussion which followed,

Mr. Ferguson Bell congratulated Mr. Leighton and the Sulphate of Ammonia Association on the pioneer work which was being done. There was no doubt that in the past they had not brought the merits of sulphate of ammonia so prominently before agriculturists as they ought to have done. He thought that Mr. Leighton had put his finger on a weak spot when he pointed out that they could not do a wholesale and a retail trade. Gas companies had in some cases sold to farmers and ignored the local merchants. But this was a step in the wrong direction. They should sell to the local corn merchants, and try to persuade them to become their agents. They must, of course, be allowed a reasonable profit; and the amount suggested, 10s. a ton, seemed to him a very fair one. There was a difficulty in regard to prices; and he considered Mr. Leighton's suggestion was a good one—namely, to try and have meetings for the different districts to fix prices from month to month, or three months to three months. They did not want prices to fluctuate too much—in fact, the more they could steady prices the better. He thought the Sulphate of Ammonia Association could help them if they would offer prizes and cups to the different local agricultural societies, and especially to farmers who grew crops by means of sulphate of ammonia as one of the artificial fertilizers. The question of bags was one that the Association should take up. They might supply a bag with a good advertisement on it. The principal point that Mr. Leighton wished to drive home, however, was that they should popularize their own make of sulphate. It was no good making sulphate of ammonia unless they could find buyers; and the only way to find buyers was to let the merits of sulphate be known. He thought the Association that Mr. Leighton represented were doing very good and very important work. In fact, if he might say so, there had been a distinct improvement in the business methods of the Association during the last twelve months. He did think that they ought not to use second-hand or old bags, but prepare their salt in bags of good, marketable quality, and suitable for use by the farmers. He believed that our enemies, the Germans, were ahead of us in this respect. They turned out many of their products in a more pleasing and marketable way than we did. We should take this lesson to heart now that there was an excellent chance of popularizing our productions.

Mr. Percy H. Fletcher (Evesham) said he disagreed with the reader of the paper when he suggested that sulphate of ammonia should be sold by corn merchants. If they wanted to sell an article, he could not conceive why they should take it to a person who had got a dozen different articles that did the same work, and expect him to sell theirs in preference. It was a question of which production he got the most profit out of. He had never found farmers or market gardeners the ignorant people that they had been set down to be. The majority of them knew well the value of manure, and, further, they did not buy much which they did not have analyzed. In his district, nitrate of soda and sulphate of ammonia were not used for the same purpose at all. It was possible to see the action of nitrate of soda in two days; but it did not do on all soil, and they did not use it now because of its action on the land. It set the soil hard. He found the farmers well posted as to what they were going to use. His opinion was that sulphate of ammonia should be sold direct. Let them get into direct touch with their customers, and see that they were fully satisfied.

Mr. A. Bird (Bromsgrove) mentioned that a large farmer in his district who had used sulphate of ammonia on a crop of potatoes had found the yield three times greater than where manure had been used.

Mr. J. T. Lewis did not agree with Mr. Bell's suggestion that the Association should supply bags. This hardly seemed necessary in the case of sulphate for home consumption. For export, there would be something to be said in favour of the provision of bags, because, after all, the importance of a new bag properly marked was greater if the consignment was going abroad than if they were sending it to a farmer immediately adjacent to their own works. Nor did he agree with Mr. Fletcher, that they should sell to farmers direct. His attempt to deal with farmers direct had not been satisfactory. Some of them took a tremendous time in paying the accounts for the sulphate when they got it. If they could get a good agent—he might be a farmer, or a man of some standing among farmers, or a corn merchant—he believed it was better to sell to such an individual. They gave him a direct interest to sell to farmers by offering him the 10s. It was important that they should create, if possible, a greater demand at home for the sulphate they manufactured.

Mr. J. S. Cranmer (Stratford-on-Avon) said that in his case they sold direct to the factor; and he found that this was the best plan. If they sold to the farmer, they had to wait for the money—sometimes they got it, and sometimes they did not. He thought the question of bags was of very little consequence. So long as he got a good bag to hold the sulphate, he did not trouble further. It was not as if the stuff was going abroad. He could always sell all the sulphate he made; and he had no trouble in doing so.

Mr. G. Helps (Nuneaton) agreed that it was an excellent thing to attempt to sell through the factors. The farmers wanted twelve months' credit at least.

Mr. A. T. Harris did not see how prices could be fixed month by month. As to the farmers, he found that they were not quite so black as they had been painted. If there was undue delay in payment, it was the fault of the sellers, because he thought the farmer, if he had a distinct understanding that he bought stuff at an advantage by paying within a certain time, was quite willing to "put a bob into his pocket." In his case, they sold the bulk of their production to factors; but he had an arrangement with them that he would never undersell them to a farmer. So that the farmer reaped no benefit by coming direct to him. He did not agree with Mr. Bell as to the bags. Everything, he thought, depended upon the local circumstances. They did not want to take the factors' business away from them. At the same time they did not want to let business slip from their hands when the factor was trying to get more than a reasonable profit.

A Member asked whether anyone could inform him of a method by which sulphate of ammonia could be produced in a flour or ordinary salt that could be put straight into the bag. Much of his output had to be broken up before it could be sent away.

Another Member contended that the farmer must be given some consideration in regard to payment; he did not get crops quarterly.

Mr. Leighton, dealing with the points raised in the discussion, fully agreed with Mr. Bell that if they could fix prices for three months it would be much better, so far as the home trade was concerned. As to prizes, he mentioned that the Sulphate of Ammonia Association were giving something like £250 or £300 in a special prize competition. One member had spoken of the results he had obtained by the use of sulphate of ammonia. He thought he might say that in Ireland they had just judged for a competition a crop of potatoes producing 24 tons 5 cwt. 3 qrs. 18 lbs. with an expenditure of 1½ cwt. of sulphate of ammonia, as compared with only 17 tons 3 cwt. from untreated land. He also agreed with Mr. Bell on the question of bags. There were parcels of sulphate of ammonia sent out by producers in this country which made him ashamed to say that he was associated with the production of the article. This did not give the farmer a good impression. He suggested the adoption of a standard bag, and mentioned that this question had been before the Association; and it had now been pretty well decided to buy bags and brand them: "Sulphate of Ammonia. For all crops." These would have been sold to members at cost price; but it so happened that bags at the present time were just about as dear as they could be, and it would be a very bad investment to buy thousands of them now. The bags could be made of such a size as to be useful later to the farmer. With regard to Mr. Fletcher's criticism, he said there were many merchants attending Evesham Market every week from the surrounding towns who were selling an enormous amount of nitrate of soda. If sulphate of ammonia was applied six weeks in advance, it answered the same purpose as nitrate of soda put on seven days in advance. It was only a question of instructing the farmer with regard to the earlier use of sulphate of ammonia. As to the 10s. profit, he agreed that it was not sufficient if the farmer had to give credit; but this profit was arranged on a cash basis. Although 10s. was mentioned as the amount, it did not prevent the corn merchant judging a particular customer saying: "You take nine or twelve months' credit, and I will have a pound out of you." There were plenty of corn merchants who would not mention sulphate of ammonia to a man, simply because they felt that their position was insecure on account of the producer cutting the trade from under their feet. It was very improbable that corn factors would have the enthusiasm to sell goods to farmers if producers took the best customers and left them the worst. He was opposed to producers dealing with farmers' co-operative societies. The societies were not very strong yet; and it must be remembered that the corn factors were as much against co-operative societies among farmers as gas producers were against electric works, and they must not favour one more than another. If there was a recognized co-operative society trading in things appertaining to the farm, he should treat them on exactly the same terms as the corn factor, but no better.

On the motion of Mr. George Helps, seconded by Mr. F. Lee (Hinckley), Mr. Leighton was warmly thanked for his address.

Informal Discussions.

Subsequently informal discussions took place, upon "Toluol Recovery," opened by Mr. Hubert Pooley, of Leicester, and on "War and Gas-Works Labour," introduced by Mr. W. H. Johns, of West Bromwich. It was determined by the Committee of the Association that both these items should be treated as private matters, and not reported.

Southern District Association of Gas Engineers and Managers.—The annual general meeting of the Association will be held at the Hotel Cecil on Thursday, Nov. 11, at 4.30, and will be preceded by afternoon tea, at 3.30. Papers will be read by Mr. W. D. Child on the "Construction of Concrete Purifiers at Romford in 1913," by Mr. F. Livesey and by Mr. R. Wardell on the "Working of Tar Dehydration Plants," and (it is hoped) by Mr. F. Durkin, of Southampton. There will also be an informal discussion on the production of toluene, which will not be reported.

PRESIDENT'S ADDRESS TO THE MEMBERS OF THE PACIFIC COAST GAS ASSOCIATION.

Another Speech by Mr. E. C. Jones.

Last week, p. 90, there was given the text of the address presented by Mr. E. C. Jones to the opening meeting of the International Gas Congress at San Francisco. During Congress Week, Mr. Jones was called upon for a second address—in his position as President of the Pacific Coast Gas Association. We reproduce the main portions of it.

The long-anticipated year 1915 finds the Pacific Coast Gas Association assembled as the host to the International Gas Congress. For years we have hoped and planned to bring together, in our beloved City of San Francisco, during the period of the Panama-Pacific International Exposition, a gathering of gas men representing every part of the world, where their efforts have carried light, heat, and power for the benefit of mankind.

The International Gas Congress was launched at our Oakland meeting in September, 1911; and it immediately received the support and encouragement of the entire gas fraternity. During the past year we have been beset with grave discouragements, with which we in California are so familiar—beginning with financial depression and industrial uncertainty, and culminating in the greatest war the world has ever known—a war engaging nearly all the great nations of the world, and of such magnitude that it makes the losses and horrors of all the wars in history seem as nothing. These conditions would have deterred any but Californians from holding an unrivalled and successful International Exposition in commemoration of the completion of the world's greatest engineering feat—the building of the Panama Canal. But, with intrepid zeal and cheerful confidence, this wonderful people—with the blood of the pioneers in their veins, and tried and not found wanting by earthquake and fire—forged ahead to success with the plans of the exposition; and this Association has joined in the spirit with the feeling that while the attendance at an International Gas Congress might not be as large as anticipated, it would bring together a representative gathering of gas men.

While the deplorable war has made it impossible for foreign gas men to be present, we feel that we have the best wishes for success of all the Gas Associations of the world, and that their members are with us in spirit. How fortunate we are to meet in this beautiful Exposition City and enjoy the blessings of peace.

THE SUPPLY OF OIL GAS.

The oil-gas business of California has prospered during the past year; and the steadily increasing production of crude petroleum has warranted the building of permanent plants, and the development of this unique and almost local method of making gas. At the time of the organization of our Association in 1893, there were a few water-gas plants in California, and the rest were coal-gas works in the various stages of the building-up of the art from iron retorts to full depth regenerative benches. The production of petroleum in California in 1893 was 470,179 barrels. By rapid strides during the life of our Association, the production of petroleum has increased until, in 1914, there were 102,881,907 barrels produced, and every foot of gas manufactured in California was made from oil.

Many years ago it was said that the crude petroleum of California would prove a greater blessing than the rich yield of gold which has made the State famous. This prophecy has been fulfilled; and the abundant oil supply, besides furnishing a cheap and ideal crude material for gas-making, is advancing the industrial importance of our State.

CALORIFIC VALUE NOW THE VOGUE.

One of the most important subjects now before gas people is the substitution of the heating value of gas for the candle power standard. The day of the open-flame burner is past; and the only excuse for candle power was to make the use of this wasteful and inefficient burner possible. Comparatively low candle power is sometimes stipulated by regulating bodies for the purpose of insuring a high heating value of gas; but if the standard heating value is placed high enough (say, 600 B.Th.U. per cubic foot as a minimum), candle power may be safely ignored, and the consumer of gas will be benefited by being spared the annoyance of naphthalene stoppages, smoky flames, and inconstant quality.

It should be the personal duty of every member of our Association to use his influence to bring about the adoption of a heating value standard of gas, for the mutual good of both the consumer and manufacturer of gas.

WORKMEN'S ACCIDENTS.

The introduction of the principle of "Safety First" into our industry has wrought wonders in the prevention of accidents to our fellow workmen. This movement is on the same humanitarian plane as the work of the Red Cross Society; and its disciples are the heroes of peace instead of the heroes of war. "Efficiency first" has been the slogan of industrial establishments before the advent of the safety campaign; but by a mingling of heart work with head work, the result is prevention of suffering and disability, restraint of careless workmen, and improvement in housekeeping, which bring higher efficiency and better workmen. It creates a feeling in the individual that he amounts to something and is worth taking care of. Our gas-works are cleaner; the scrap-heaps have disappeared; and the efforts for safety are rewarded by actual economy.

The effectiveness of "Safety-First" work is shown in a report of one of the large gas undertakings on the Pacific Coast, which has an organized system of prevention and correction by committees. The fatal industrial accidents during 1913 were 16; while in 1914 there were 8—a reduction of just one-half. In 1913 there were 822 industrial accidents reported, as against 695 in 1914. This is a remarkable showing, when it is considered that the Workmen's Compensation Act was not in force in 1913, and in 1914 the workings of this law necessitated the reporting of trivial accidents which would have been entirely overlooked before the law went into effect.

Many of the hysterical features of "Safety-First" work in the beginning have already worn-down to their bearings; and the work is now proceeding along saner lines with better and more permanent results.

THE GAS EXHIBITS.

The "Collective Gas Exhibit" at the Panama-Pacific International Exposition is the first collective exhibit of the gas industry at any International Exposition. The idea originated with the American Gas Institute, whose Committee interested the manufacturers, and disposed of the spaces in the exhibit—thus securing its financial success.

The exhibit occupies 10,000 square feet of space in the northwest corner of the Palace of Manufactures; and the construction of the fine pavilion and the work of conducting the exhibit have been done under the management of a Committee of the Pacific Coast Gas Association, of which our Vice-President, Mr. Frank A. Cressey, jun., is Chairman.

CONCLUSION.

After referring to the awards in connection with the gas part of the exhibits, and alluding to the deaths that had occurred last year in connection with the Association, Mr. Jones concluded his address with these words: "Your President urges faith in the gas industry—faith accompanied by an aggressive spirit to increase the extent and glory of our business, and never rest until our product is universally used for every purpose, domestic and industrial, in a field which belongs to us, and competition should only serve to stimulate us to renewed efforts."

SIXTY YEARS AGO.

From the "Journal" for October, 1855.

Notice to Subscribers. — We some months since announced that we had under consideration a project for the conversion of this "JOURNAL" into a bi-monthly publication of sixteen pages, whenever it appeared to us that materials could be depended upon for such an extension. The numerous supplements and enlarged numbers we have from time to time been compelled to give to keep up with the accumulation of matter, satisfies us that the time is approaching for carrying our project into effect; and we have consequently resolved to commence the new issue in January next, when the subscriptions for the current year will have expired. In making this announcement, we cannot refrain from expressing our gratitude for the favour with which our exertions to establish an independent organ for the circulation of information interesting to an important branch of our national industry has been received; and we pledge ourselves to spare no exertion or expense to render it worthy of the extensive support and confidence it enjoys.

Statutory Powers.—The period is close at hand for giving notices of intended applications to Parliament during the session of 1856 for the incorporation of joint-stock companies; and we again urge upon unincorporated gas companies and private owners of gas-works, the advantage of obtaining statutory powers for carrying on their operations, as some protection against the pressure brought to bear on them by local bodies whenever an opportunity offers for wringing some concession from their fears. The vicious system of supplying public lights at less than the prime cost, has been, to a considerable extent, fostered by the irregular manner and uncertain tenure upon which many parties have invested their capital in gas-works, and who, to save a portion of their property from confiscation, which would have been the result of competition, have from time to time submitted to exactions repugnant alike to the sound principles by which commercial transactions should be regulated, and to common sense. Instances come before us every day of sacrifices thus made, which a few hundred pounds invested in obtaining Acts of Incorporation would have prevented; and each successive year increases the severity of the conditions imposed upon applicants for Gas Acts. A maximum price, which may be deemed by the Legislature to be reasonable this year, may not be so considered next; and hence those who delay taking the requisite steps for strengthening their position this year, may find the obstacles greater in succeeding years.

PRODUCTS AND BYE-PRODUCTS OF COAL.

A Canadian Bulletin.

There has been submitted to the Canadian Department of Mines a bulletin, on the "Products and Bye-Products of Coal," prepared by Mr. Edgar Stansfield, M.Sc., and Dr. F. E. Carter, B.Sc., the subject-matter of which is divided into two parts: The production of coke, gas, ammonia, and tar from bituminous coal; and the properties and uses of these products and bye-products. Other fuels than bituminous coal are dealt with, but only in a tentative way, since bituminous coal is of overwhelmingly greater importance than any other fuel as a medium from which to obtain the commercial products particularized in the first part. In setting forth the results of these investigations, the aim has been to give prominence to the commercial rather than to the scientific aspect of the subjects treated—more especially as regards their bearing on existing conditions in Canada.

The present time, it is remarked, is particularly opportune for discussing the question of establishing new lines of trade and commerce; for, on account of the deplorable war conditions in Europe, all industries are more or less dislocated as regards supply and demand, and manufacturers everywhere are taking stock of current conditions, and considering future possibilities. The trade possibility that would naturally occur to most people interested in the commercial development of Canada is the establishment of a coal-tar dye industry; since here, as in other countries, factories using dyes are being seriously inconvenienced, owing to the fact that Germany—by a combination of scientific research, technical ability, and commercial energy—has for years had practically a monopoly in the manufacture and supply of coal-tar dyes, and, consequently, since the opening of the war importation of this commodity from Europe has almost ceased. The importation of dyes into Canada is, however, not large, and the prospect of developing a flourishing coal-tar dye industry is not encouraging. But offsetting this negative view is the encouraging fact that there are other important bye-products from coal which, though not figuring so prominently in the public eye, are nevertheless of much greater importance commercially. A number of these are peculiarly suitable for production in Canada; and the Dominion could thus be rendered less dependent on foreign sources of supply.

The first part of the bulletin, after setting forth concisely the different methods of production of coke, gas, ammonia, and tar, goes on to compare types of coke-ovens. Until recent years, it is said, there has been a decided prejudice against retort-oven coke. The product of beehive ovens has been more in demand, especially for use in blast-furnaces. This preference, however, is fortunately disappearing. As a matter of fact, retort-ovens can make as good coke as beehive ovens, and can make more of it from ordinary coking coals. They have, moreover, a wider range of adaptability, as they can produce a commercial coke from certain classes of coal which cannot be coked in a beehive oven. Hence the retort-oven is gradually displacing the beehive oven; and in some countries the change is almost completed.

Beehive ovens, as a rule, are a nuisance in the neighbourhood where they are located. They burn or waste all the gases and volatile matter generated from the coal; and they give no return except that of the coke they produce. Moreover, they also burn about 10 per cent. of the coke itself. In other words, if, with a certain coal, a 75 per cent. yield of coke is obtained in a retort-oven, probably only 65 per cent. would be obtained in a beehive oven. In the former case, 134 tons of coal would be required to produce 100 tons of coke; whereas in the latter case 154 tons would be required. That is to say, for every 100 tons of coke produced in a beehive oven, 20 tons of coal, approximately, are needlessly wasted through the burning of the coke. From the ethical point of view, therefore, there can be no hesitation in condemning the beehive oven; while from the practical point of view it should be remembered that, in addition to the smaller yield, the greater waste of carbon in the beehive oven results in a higher percentage of ash in the coke produced. The beehive oven has the further disadvantage that the coking period is at least one-and-a-half times as long as in a retort-oven; so that, if the charges are the same, it takes three beehive ovens to do the work of two retort-ovens. The cost of working a beehive oven is also high, as the method of drawing the coke by manual labour is slow and expensive. The beehive oven is, however, very low in first cost, and being simple in construction is also easy to keep in repair. These facts, together with the widespread prejudice in its favour, and the great number of managers and men familiar with its use—but unfamiliar with retort-oven practice—explain the reluctance of so many coke manufacturers to adopt retort-ovens. It is probable that in nearly all cases the non-recovery retort-oven is, in the long run, more profitable than the beehive oven; and that it would certainly prove to be so in all large plants. The capital outlay is greater, but the working expenses are less; while the output of coke is at least 10 per cent. more for the same amount of coal used.

In Canada, at the present time, the profits to be gained by the recovery of bye-products are more doubtful. On account of the high capital cost of a bye-product plant, it is essential that there should be a reasonable certainty of working full time. Hence it is usual to erect large central plants, where they are capable of drawing supplies from several collieries, and where a good market for the products is easy of access. It seems certain that bye-product recovery coke-oven plants which produce tar, and the coal-tar industry which uses coal tar as a raw product, must grow up together. At the present time, there are only two bye-product recovery coke-oven plants operating in Canada. Yet in 1913 these two plants were responsible for two-thirds of the total coke production of the Dominion. As coke is imported, however, their production only amounted to one-half the total consumption of coke in Canada.

No official statistics are available to show the weight of coal coked annually in Canadian gas-works, and the corresponding yield of gas, coke, &c.; but Mr. A. Hewitt, the General Manager of the Toronto Consumers' Gas Company, states that approximately 5,000,000 gallons of tar are produced annually. Some idea of the relation between the coal coked and the products obtained at modern gas-works can, it is said, be obtained from figures published in the "JOURNAL OF GAS LIGHTING," showing that the average residuals obtained in 1913 by the three London Gas Companies per long ton (2240 lbs.) of coal coked were: Coke, 12·47 cwt.; coke breeze, 5·20 bushels; tar, 10 gallons; ammoniacal liquor, 36·11 gallons of 8 oz.; gas, 12,420 cubic feet. The ammoniacal liquor referred to is of such a strength that 8 oz. of pure sulphuric acid are required to neutralize the volatile ammonia in 1 gallon of the liquid. This corresponds to 0·674 lb. of ammonium sulphate per gallon; but the actual yield obtained is not stated. Although the above are called residuals, it is obvious that the weight of coke stated is the gross yield, rather than the net weight left after heating the retorts. The three companies in question used approximately 20·3 per cent., 21·1 per cent., and 12·3 per cent. respectively (mean 18 per cent.) of the coke produced to heat their retorts. Subtracting 18 per cent. from the above coke yield, and assuming that a bushel of coke breeze weighs 50 lbs., then the net yields per 100 lbs. of coal coked are approximately: Coke, 60 lbs., tar 0·45 gallon, gas 550 cubic feet, ammonium sulphate 1 lb.

The data collected by the Division of Mineral Resources and Statistics of the Mines Branch, show that, in 1913, 2,147,913 short tons (2000 lbs.) of coal were carbonized in Canadian coke-ovens, and 1,517,133 tons of coke produced therefrom. Of the above, 1,456,361 tons of coal were coked in bye-product recovery coke-ovens, with the production of 1,018,632 tons of coke, 8,371,600 gallons of tar, 10,663 tons of ammonium sulphate, and 3,353,831,100 cubic feet of surplus gas. The corresponding yields per 100 lbs. of coal are: Coke, 70 lbs., tar 0·29 gallon, gas 115 cubic feet, ammonium sulphate 0·73 lb. These figures are not comparable with those from the London Gas Companies, as no analyses of the coal coked are given in either case.

No statistics of the output of producer gas in Canada are so far available.

In the second part of the bulletin, the properties and uses of coal products and bye-products are explained in a useful manner. As to coke, it is pointed out that recovery coke-oven practice yields a proportionately larger supply of solid as compared with gaseous fuel than is the case with ordinary gas-works practice, because at the coke-ovens gas is used to supply the heat for coking, while at the gas-works coke is used for this purpose. Modern bye-product recovery coke plants have recently been installed in certain places as a means of supplying city gas; but such installations are only possible where there is a good demand for metallurgical coke. A study of the statistics of coke suggests that, in some Canadian cities, a coke-oven plant might possibly prove more profitable than a gas plant. During 1913, the coke imports exceeded the exports by 655,671 tons—an amount greater than the coke production of either of the two bye-product coke-oven plants. In 1913, 1,517,133 short tons of oven coke were produced in Canada, and 1,530,499 tons were sold or used by the producers. The exports amounted to 68,235 tons, and the imports to 723,906 tons.

The table gives actual analyses of a city gas, a coke-oven gas, producer gas, and, for comparison, a natural gas. The calorific values are in British thermal units per cubic foot of gas measured moist at 60° Fahr., under a pressure of 30 inches of mercury. The assumption is made that the saturated hydrocarbons are all methane, and the unsaturated hydrocarbons ethylene. This

Examples of Gas Analyses.

—	City Gas.	Coke-Oven Gas.	Producer Gas (Coal).	Natural Gas.
	1.	2.	3.	4.
Hydrogen . . . . . per cent.	39·5	48·5	12 5	..
Saturated hydrocarbons . ,,	31·8	32·8	3·3	91·6
Unsaturated hydrocarbons. ,,	5·1	3·6	0·2	..
Carbon monoxide . . . ,,	14·6	5·5	10·7	..
Carbon dioxide . . . . ,,	1·7	2·4	10·1	..
Oxygen . . . . . ,,	0·6	0·3	0·8	0·2
Nitrogen (by difference) . ,,	6 7	6·9	62·4	8·2
Inflammable gases . . . ,,	91 0	90·4	26·7	91·6
Calorific value—				
By calculation, gross B.Th.U. . .	574	560	111	916
By calculation, net B.Th.U. . . .	516	500	101	822

No. 1. Montreal city gas, which is coal gas mixed with carburetted water gas.
,, 2. Coke-oven gas from Nova Scotia coal coked in Otto-Hoffman oven.
,, 3. Nova Scotia coal in M'Gill gas-producer.
,, 4. A natural gas from Alberta.

probably causes no appreciable error in the calculated calorific value for a producer gas; but it is liable to cause a serious error in the case of a city gas, and an even greater error when applied to an oil gas. Determinations made with a Boys gas-calorimeter showed the actual gross calorific value of the city gas given in the table as 636 B.Th.U.; and of the natural gas, 930 B.Th.U.

The production of city gas in Canada is largely reduced by the competition of natural gas. There are at present some 39 companies supplying city gas; the net prices charged per 1000 cubic feet for illuminating purposes ranging from 70 c. to $2·40. There are 23 companies employed in the distribution of natural gas; the corresponding prices ranging from 15 c. to 70 c. The production of natural gas in Canada in 1913 was, approximately 20,345,000,000 cubic feet. The output of surplus coke-oven gas in Canada in 1913 amounted to 3,354,000,000 cubic feet.

The uses of gas are touched upon, and then ammonia, cyanides, and tar are dealt with. A particularly useful section of the work is that regarding the commercial products of coal tar; their uses and derivatives being enumerated in some detail. Under the heading of the "Colour Industry," one notes the remark that "it would be a difficult matter, and probably an unprofitable one, to attempt at present to form a coal-tar dye industry in Canada." The Canadian production, exports, and imports of the different materials referred to in the bulletin, for the years 1912 and 1913, are given in a table which brings the work to a close.

PACIFIC COAST GAS ASSOCIATION.

[From Our Own Correspondent.]

Among the Gas Association meetings held in connection with the International Gas Congress was the twenty-third annual convention of the Pacific Coast Gas Association. This body took the first steps towards the congress, and in true Californian style acted as hosts to the Eastern visitors. Every man enrolled for the congress, and in this way guaranteed the financial resources needed for publication and other expenses.

In order not to interfere with the sessions of the congress, the meeting of the Association was confined to one sitting, and to committee reports.

With an attendance of several hundred, the chair was taken at 10.25 A.M., on Sept. 27, by the President, Mr. E. C. Jones, of San Francisco. Mr. Jones occupies this year somewhat the position that Sir Corbet Woodall did in the Jubilee year; for he is also President of the American Gas Institute.

In some introductory remarks, Mr. Jones called to mind that nineteen years ago he had presided as President over the same Association. He attributed the prosperity of the industry on the Pacific Coast in the intervening years to the spirit evinced by his fellow workers. He then called on Dr. Alex. C. Humphreys, as President of the International Gas Congress, for a word of greeting. Dr. Humphreys desired to add his tribute to the spirit of the Coast, the enthusiasm which leads to prosperity. In reply to Dr. Humphreys, Mr. John A. Britton stated that California had often "blazed trails in gas practice."

The Treasurer's report showed a satisfactory balance; and the Secretary reported 354 members, not including 30 subsequently elected by the meeting.

The Directors reported in favour of Santa Barbara, Cal., for the 1916 meeting. It was recommended to appoint a Committee to bring about adequate sizes of house-piping for gas. This action was undoubtedly suggested by the forthcoming report of the Institute's Committee on the subject; and this, in turn, illustrates how one Association can help another.

For the Committee on Gas Engineering, Mr. Britton reported contributions extending for five years, of an annual value of about $3000. These have enabled a full course in gas engineering to be offered by the University of California. A description of this movement, and of the course, appeared in "Gas Age" last August.* In brief, the course is a combination of mechanical engineering and chemistry. Dr. Humphreys, in commenting on the report, said that the Pacific Coast Gas Association should keep in touch with the course at all times, and, as the founders, could always suggest views as to its practical side. In general, in such a course over-specialization should be avoided.

Dr. C. C. Thomas, of Johns Hopkins University, thought they were fortunate in having on their teaching staff a gas engineer who combined practical experience with scientific attainments. They were working to enable the United States to cease its dependence on foreign nations for the bye-products of gas manufacture. Professor Corey, who has charge of the course, said a college education was justifiable only in so far as it trained the mind rather than merely imparting information. He thanked the Association for their material, and to a greater degree for their moral support.

The Librarian reported 104 accessions—making a total of 1202 volumes—and a record circulation during the past year. This is the only Gas Association in this country that has been successful in such use of a library.

The President then delivered his address [see p. 134]. Speaking to the members as hosts of the International Gas Congress, he said that while war had prevented any foreign representations, he felt that their fellow workers in other countries were present in spirit, and that the Association were indeed fortunate in being able to be in San Francisco under peaceful conditions. He spoke of the rapid development of oil gas, and its present firm establishment in California as the sole manufacturing process. He declared that the only use of the candle-power standard had been to make possible the employment of the wasteful flat-flame burner; that a proper calorific standard ensured good gas; and that gas men everywhere should work for such a standard in the interests of both sellers and users. He characterized the "Safety First" movement as mingling heart work with head work. In one large company there had been in 1913 sixteen fatalities, and in 1914 only eight; in 1913 822, and in 1914 695 accidents, and the latter notwithstanding the fact that in 1914 a new law required the reporting of many trivial accidents not recorded in 1913. He referred to the "Grand Prize" that had been awarded by the exposition to the "Collective Gas Exhibit." He called for faith in the industry accompanied by an aggressive spirit until gas was used in every field belonging to it.

Mr. John A. Britton, as Chairman of the Committee on the President's Address, in a few informal remarks, bore testimony to Mr. Jones's unflagging enthusiasm for gas, and his success in establishing a calorific standard in California.

The meeting closed with the election of the office-bearers for next year.

* The proposals here referred to formed the subject of an article in the "Journal" last week, p. 92.—Ed. J.G.L.

SCOTTISH JUNIOR GAS ASSOCIATION.

(EASTERN DISTRICT.)

Opening Meeting of the Session.

The Scottish Junior Gas Association (Eastern District) held their opening business meeting for the coming session last Saturday in the Heriot-Watt College, Edinburgh.

The President's Medal.

Mr. R. B. Chalmers, the retiring President, on vacating the presidential chair, was presented with a medal to commemorate his year of office, for which he returned thanks.

THE PRESIDENT'S ADDRESS.

The President (Mr. J. J. Scott, of Lower Largo), in his opening address, said: I thank you for the honour conferred on me by electing me your President for this year. To-day our numbers stand at 76 ordinary and 14 honorary members, which is quite up to previous years, and augurs well for continued success.

ROLL OF HONOUR.

A "Roll of Honour" is being prepared, as an appreciation of our admiration for those members who have taken their stand for King and Country. At the present time we have the following names to inscribe; and I would mention that there is plenty of room for more.

Lieut.-Col. Henry O'Connor . . .	O/C Inner Defences of the Forth.
Lieut. L. Farquhar (Alloa) . . .	Cameron Highlanders.
Trooper J. H. Bell (Callender) . .	Scottish Horse.
Sergt. A. Leitch (Cardenden) . .	Black Watch.
Private J. B. Scott (Cowdenbeath) .	„ „
Private D. D. Bruce (N. Berwick) .	Royal Engineers.
Private J. Lindsay (Dundee) . . .	—
Gunner J. H. Marshall (E. Wemyss)	Royal Garrison Artillery.

Although we cannot all go with them, it lies with us to do what we can in our various spheres to help them in their effort to maintain that freedom of life which we claim as our heritage. It may be that, because of one joining the forces, his work has been divided up among his fellow-workers, or that the heavy demands of war work in our district cause us to work at high speed and overtime. Let us do it with a glad heart as part of our effort to help our fellow members.

THE TECHNICAL PRESS AND THE JUNIORS.

It is very complimentary to the Juniors that the Technical Press of our industry devote so much of their valuable space to us. Ever since the inception of Junior Associations they have shown a kindly interest in our doings, and encourage us in our effort to attain and maintain the work we set out to do. These journals bring to us every week all kinds of information of an educative kind, ranging from regulating burners to subjects beyond our ken.

THE FUNCTIONS OF THE ASSOCIATION.

I think at this point it would be refreshing to review the functions of our Association. We meet to discuss subjects relating to our work, so as to obtain and give knowledge to one another. Visits are arranged to gas-works, collieries, and manufacturing works allied to our industry, so that we gain an insight as to the extent and importance of the gas industry. We arrange for lectures on various subjects; while we have a circulating library open to all and containing the best books relating to the various departments. By these means we get knowledge and enlightenment on our work, and the various ideas and opinions of the past

as well as present experts, and thus prove the advantage of our Association.

Outside the Association we are well acquainted with other ways of extending our knowledge, by means of evening and correspondence classes. But there is another source of learning which is sometimes overlooked, and that is the scene of our daily work. Whether it be in the works, district, or office that we are doing our part, we are carrying into effect, gradually, the designs and plans of our superior. We have him as our teacher, and his management for our experience; while we get acquainted with his ideas, adopt his methods, and all the time gain sound, practical knowledge in a manner which cannot be excelled. When the opportunity occurs that we may become "Senior" and have the full charge of a works, we have confidence in ourselves, a splendid training to start with, while we get the opportunity to put to the test our own ideas and opinions.

The high standard to which the junior must attain, and the training required, make it quite necessary he should obtain a certificate as to his qualifications. The City and Guilds of London Institute is, to my knowledge, the only place at present where examinations in gas manufacture and gas supply are held. These consist of two grades, with two classes in each grade, for each subject. The certificates granted are recognized by the profession, and are undoubtedly a very great help to one.

It has occurred to me that the Junior Associations could assist their members very much in this matter, by bringing before them the full particulars of these examinations, and encourage them to go forward. The members of this Association are not all in the position of being able to attend classes dealing directly with our work; and it appears to me that our meetings and visits could be arranged to assist more directly towards these examinations. Our session's work would be put to the test; while our library would be playing its proper part among members. I sometimes think that we Juniors are inclined to be a little forgetful of the greatness of the industry which we are training for as our life-work. It may be that we know it so well in our own way that we are quite confident of it; while we look on it as a public necessity for supplying light, heat, and power.

THE GAS INDUSTRY IN WAR TIME.

This view, whether it be right or wrong, gave me the idea to put before you a short *résumé* of our "Industry in War-Time." With the outbreak of war came a serious shortage of coals, through interrupted traffic caused by military requirements; and the manner in which gas-works were able to keep up a supply of gas under the circumstances is a page of our industry's history which will always be read with pride. At the same time many gas-works suffered by employees joining the forces; and in this our industry has played its part. The Past-President of the North British Association intimated that 1400 gas-works employees from Scotland, out of a total of 7000, had joined.

Most of us will have had some experience of the way in which gas is being utilized by military authorities and Government contractors; and I believe records are being broken in our zeal to make use of the opportunity afforded, to show that gas is the thing—the three in one, unequalled for light, heat, and power. When we hear of orders for 1000 lights for soldiers' huts in some districts, batteries of cookers, boilers, water-heaters, steamers, and all manner of cooking and heating appliances in other districts, we learn that the authorities find gas suited to their wants and efficient in its work.

Then, again, the extra demands made upon hospitals, public institutions, schools, halls, and billets, has necessitated an extension of cooking and heating appliances, including hot-water supply; while for concentration and military camps, &c., gas is used wherever it is available.

Having referred to the use of gas for the various processes of munition manufacture, as well as for hardening and tempering the tools in connection therewith, the President proceeded:

The application of gas for power purposes is also finding scope among the small traders who have been left short-handed of men, or the trader who has found the war creating extra work for him. The easy and simple way of fitting in present-day gas-engines, and their reliability in working, along with their cleanliness and ease of starting-up, has put a demand on them.

RESIDUALS.

Turning, now, to our residuals, we find that coke is in great demand; and in iron works, steel works, and foundries throughout the country it is used extensively in various departments, also for the making of carburetted water gas for gaseous fuel.

We now have a look into our tar and liquor storage tank, and in this we have the most interesting liquids known. Tar is playing a wonderful part, containing as it does the elements of the most powerful destructive agent, and also the most effective antiseptics known. It is also the source of the famous aniline dyes; while it occupies a prominent place in the chemist's shop. It is the most interesting bye-product in our business, when one considers it is the source of such a variety of chemicals, ranging from curing headaches to making roadways. In "Newbigging's Handbook" a very interesting table is given showing particulars of substances obtained in the manufacture of coal gas and the working-up of the residuals. The list contains about 290 substances.

Sulphate of ammonia is doing its bit, although possibly in a quieter way. Farmers are urged to increase their crops as much as possible; and in sulphate of ammonia they have a manure or land-food of exceptional value to them.

WAR WORK OF ALLIED INDUSTRIES.

Coming, now, to the allied trader of our industry, we find the steel tube makers and the gas-plant firms engaged very much on armament work; while the gas-stove manufacturers are turning out plant to make munitions and various other necessities. The gas-meter manufacturers are doing their bit, by supplying trench periscopes, dixies, mess-tins, and various parts of the shells, some of which are much more intricate than a gas-meter.

If a visit could be paid to-day to all the works that in ordinary times are manufacturing articles connected with the gas industry, it would be found that the variety of work that was being undertaken in the turning out of munitions is something extraordinary. Every company or firm has endeavoured to devote its machinery and plant to the service of the War Office or Admiralty; and the ingenuity that has been brought to bear in adapting machines and tools for the production of work that they were never intended to turn out reflects the highest credit on all who had to do with the transformation. The multifarious work that is being produced in the factories connected with the gas industry it is not desirable to make known publicly.

I refrain from dealing any further on this subject, because at a later date we will have more freedom to review in fuller detail what our industry's part has been in this terrible struggle. But I trust what little I have said may increase your enthusiasm towards the industry.

Distribution Extensions and Alterations at Markinch.

Mr. J. D. Luck (Markinch), then read a paper, which, with a report of the subsequent discussion, will be found on p. 143.

THE COMPOSITION OF COAL.

In the current issue of the "Journal of the Chemical Society" is a paper by Messrs. D. T. Jones and R. V. Wheeler, giving an account of their further studies on the composition of coal. From their previous researches [see "Journal," Vol. CXXVIII., p. 294] on the distillation of coal in a vacuum at low temperatures, they concluded that the "resinous substances" only of the coal conglomerate had suffered decomposition. They have now distilled separately in a vacuum the several portions into which coal can be divided by the solvent action of pyridine and chloroform, and find that whereas the main bulk of the liquid distillates from coal as a whole undoubtedly arises from decomposition of the "resinous substances," the "humic substances" also yield liquid products—a small proportion only, but of destructive character.

The present research also confirms the statement previously made, that the portion of coal insoluble in pyridine and the portion soluble in pyridine but insoluble in chloroform, both consist mainly of the humic class of compounds; while the portion soluble both in pyridine and chloroform is almost entirely of the resinous character. The humus substances yield as liquids mainly phenols; the resinous substances giving paraffins, olefines, and naphthenes, but no phenols. The suggestion is that the portion of the coal insoluble in pyridine should be regarded as derived from the woody fibre or celluloses of the original coal plants; and in confirmation of this it has previously been shown that cellulose yields phenol on distillation. The coal experimented with was an ordinary bituminous one from a Durham mine.

In the distillation of the portion of the coal soluble both in pyridine and chloroform, some of the mass softened at 102° C.; and at 170° C. gases were evolved. At 250° C., considerable quantities of paraffin were distilled over, mixed with some resinous matter. Large quantities of gas were evolved at 320° C. and higher, and had the following composition:

	Per Cent.		Per Cent.
Olefines	0·1	Carbon monoxide	8·4
Carbon dioxide	2·0	Hydrogen	*Nil*
Ethylene	1·9	Paraffins	87·6

The material left in the flask after distillation to 400° C. was a hard compact pitch completely soluble in pyridine. The difference in character between the hard pitch formed from this portion of the coal and the incoherent powders remaining after the portion soluble in pyridine but insoluble in chloroform and insoluble in pyridine clearly demonstrates the fact that the coking properties of coal are due to the resinous constituents. The distillation of the humic substance gave acid water and oil; the latter consisting chiefly of phenols.

As with the resinous material, the gases evolved below 300° C. consisted almost entirely of carbon dioxide and monoxide in the ratio 3:1. The gases evolved between 300° C. and 450° C. showed the following composition:

	Portion Insoluble in Pyridine.	Portion Soluble in Pyridine, but Insoluble in Chloroform.
Olefines	0·4	0·2
Carbon dioxide	3·7	4·4
Ethylene	5·1	5·2
Carbon monoxide	13·6	12·1
Hydrogen	14·8	19·1
Paraffins	62·4	59·0

At the meeting of the Junior Institution of Engineers on Friday next a paper on "Safety Precautions for Transmission Machinery" will be read by W. V. H. Capps.

HEAT TREATMENT OF IRON AND STEEL IN A NEUTRAL ATMOSPHERE.

The Use of Illuminating Gas for the Purpose.

At last month's Detroit meeting of the Michigan Gas Association two papers were presented by Professor ALFRED H. WHITE and Mr. HOMER T. HOOD, the Holder of the Michigan Gas Association Fellowship in Gas Engineering at the University of Michigan. One paper was entitled "Gas as a Case-Hardening Agent;" the second "The Heat Treatment of Iron and Steel in a Neutral Atmosphere." Next week we shall be reproducing the main portions of the former communication. To-day we deal with the second one—depending on a corrected copy of the paper received from Professor White, who is head of the Chemical Engineering Department at the University.

INTRODUCTION.

When iron or steel is heated to a high temperature for purposes of forging or heat treatment in a furnace where it comes into direct contact with flames, smoke gases, or other oxidizing atmosphere, its surface becomes first decarburized and then oxidized and covered with scale. Not only is the actual loss of metal in heating for the forge of considerable importance, but surface decarburization is becoming of greater importance in view of the high standards demanded by tool manufacturers and the automobile industry. Mr. J. G. Ayres, jun., in a recent paper ["Proceedings of the American Society for Testing Materials"] has shown that the surface of metal as received from the rolling mill may show decarburization to a depth of about 0·015 inch, and that metal to this depth must be removed from the surface to eliminate all trace of decarburization. He states that decarburization due to heat treatment at lower temperatures is evident though not so serious. It is possible to avoid these undesirable changes by heating the metal in an externally-fired muffle filled with an inert gas such as nitrogen. Externally fired muffles, however, always show a low thermal efficiency, and there are difficulties in the production and utilization of nitrogen. Since heating in illuminating gas alone has been found to cause carburization of steel, while heating in the ordinary products of complete combustion has been found to cause oxidation, it seemed that somewhere between these two extremes should be a composition practically neutral in its effect on steel—that it should be feasible to construct a muffle-furnace with semi-direct firing, in which a mixture of gas with a small amount of air should burn within the muffle to form a neutral atmosphere, and subsequently burn with more air around the muffle, and utilize in this way the full thermal energy of the gas.

DISCUSSION.

Whenever a number of substances are allowed to react with each other for a sufficiently long time, they finally come to a definite stable condition called equilibrium. This equilibrium will vary with the temperature, pressure, and concentration of the substances present. A full solution of the problem here presented would call for a study of the equilibrium between the various possible compounds formed by the interaction of iron, carbon, hydrogen, and oxygen. Such a complete solution, however, would demand a prohibitive amount of experimental work. For practical purposes, it is not absolutely necessary that the atmosphere be strictly neutral; for the rate of reaction decreases as equilibrium is approached, so that there will not be serious change in the surface of the metal if the time of heating be short, even though there is a tendency toward a reaction in one direction or the other.

Although the equilibrium in the complicated system (iron, carbon, hydrogen, oxygen) has not been worked out, the simpler system (iron, carbon, oxygen) has been studied by several authors, and is summarized by Arndt ["Technische Anwendungen der physikalischen Chem."]. From his figures it may be seen how great an influence is exerted by temperature. At 1100° Fahr., iron will not be oxidized by a gas which carries 75 parts of CO_2 to 25 parts of CO, while at 1400° Fahr. not more than 15 parts of CO_2 can be allowed to 85 parts of CO if oxidization is to be avoided. The figures have not been worked out for the higher temperatures; but it is evident that still smaller proportions of carbon dioxide—the oxidizing gas—must be maintained if oxidization is to be avoided at high temperatures. These considerations make it evident that it will be difficult to use producer gas for the production of a neutral atmosphere at high temperatures, since its active constituent, CO, is almost necessarily associated with several per cent. of CO_2 as it leaves the producer, and any attempt to obtain a partial combustion in the presence of the steel would necessarily produce an oxidizing atmosphere.

PREFERENCE FOR ILLUMINATING GAS.

Illuminating gas presents better possibilities than producer gas, on account of the high percentage of hydrogen and hydrocarbons, which act as reducing agents. But in the flame from illuminating gas there will be present not only carbon dioxide as an oxidizing agent but also steam; and if oxidization of the metal is to be avoided the sum of these oxidizing gases must be kept low. A mixture of illuminating gas and air which contains less than 80 per cent. of air is no longer explosive, and will not support combustion unless it receives heat from some external source. This condition is approximately realized in the ordinary bunsen flame. Arndt, in his summary of the work of various authors, gives the average composition of the inner bunsen flame to be:

Reducing Gases.	Per Cent.	*Oxidizing Gases.*	Per Cent.	*Inert Gases.*	Per Cent.
CO	2·2	CO_2	7·2	N	66·6
H_2	2·8	H_2O	20·2		
CH_4	1·0				
	6·0		27·4		66·6

The oxidizing gases in the inner cone are, therefore, four-and-a-half times as great as the reducing gases; and the mixture must exert a strongly oxidizing action on steels at high temperatures. If the amount of carbon dioxide and water vapour is to be kept so low as not to give an oxidizing flame, there will not be enough air in the mixture to support combustion under ordinary conditions. A part of the problem is, therefore, to design a furnace which will give high temperatures and yet burn a very rich mixture of gas and air.

ATTAINMENT OF HIGH TEMPERATURES IN A NEUTRAL ATMOSPHERE.

In ordinary complete combustion of gases, the final products of combustion are CO_2 and H_2O. In the method here proposed, the combustion within the muffle will be very incomplete; and it is desirable to know what temperature it is possible to attain in these circumstances. In order to calculate the theoretical combustion temperature, it is necessary to calculate the volume of the several products of combustion and the amount of heat evolved in the combustion. The gas available was an unenriched coal gas with an average heating value of somewhat over 600 B.Th.U. per cubic foot; and it was found possible to burn this in the furnace described later with two volumes of air. The calculations for the volume of the products of combustion and the theoretical flame temperature are shown in Tables I. and II. The volume of the products of combustion is calculated in two ways which check closely. The simplest method is to work from the percentages of nitrogen; and by this method the volume of combustion gases from 1 cubic foot of gas and 2 cubic feet of air is calculated from Table I. as

$$\frac{12{\cdot}5 + 153{\cdot}4}{52{\cdot}6} = 3{\cdot}16 \text{ cubic feet.}$$

The calculation based on the hydrogen contained in the incoming and outgoing gases is

$$\frac{120{\cdot}2 + 6{\cdot}0}{39{\cdot}7} = 3{\cdot}18 \text{ cubic feet.}$$

The average of these two figures, or 3·17 cubic feet, is, therefore, taken as the volume of the products of combustion of 1 cubic foot of gas with 2 cubic feet of air. Applying this figure to the values for carbon in the gas, as given in Table III., and multiplying the 18·7 volumes of carbon in the combustion gas by 3·17, the figure 59·2 is obtained as that which should correspond to the carbon (calculated as gas) in 100 volumes of the inflowing gas. The actual figure for the inflowing gas is 60·6, which is 1·4 volumes greater than the amount found in the combustion gases. This corresponds to the free carbon which produced a slightly luminous flame within the retort.

TABLE I.—*Volume of Products of Combustion Obtained from 1 Cubic Foot of Gas and 2 Cubic Feet of Air.*

Constituent.	Percentage Composition of Gas.	Air.	Products of Combustion.
H_2O vapour	3·0	3·0	15·6
CO_2	1·8	—	2·5
Illuminants (C_4H_6)	4·7	—	0·9
O_2	1·1	20·3	0·0
CO	6·9	—	9·8
CH_4	33·1	—	2·8
H_2	36·9	—	15·8
N_2	12·5	76·7	52·6
Total	100·0	100·0	100·0

Constituent.	Total Vol. H_2 Entering into			Total Vol. N_2 Entering into			Total Vol. C. Entering into	
	100 Vols. Gas.	200 Vols. Air.	100 Vols. Comb. Gas.	100 Vols. Gas.	200 Vols. Air.	100 Vols. Comb. Gas.	100 Vols. Gas.	100 Vols. Comb. Gas.
H_2O	3·0	6·0	15·6	—	—	—	—	—
CO_2	—	—	—	—	—	—	1·8	2·5
Illuminants (C_4H_6)	14·1	—	2·7	—	—	—	18·8	3·6
CO	—	—	—	—	—	—	6·9	9·8
CH_4	66·2	—	5·6	—	—	—	33·1	2·8
H_2	36·9	—	15·8	—	—	—	—	—
N_2	—	—	—	12·5	153·4	52·6	—	—
Total	120·2	6·0	39·7	12·5	153·4	52·6	60·6	18·7

TABLE II.—*Theoretical Flame Temperature Obtained from 1 Volume of Gas and 2 Volumes of Air.*

(Net Heating Value of 1 Cubic Foot Illuminating Gas Burned Completely.)

Constituents of Gas.	Net Heating Value B.Th.U. per Cubic Foot.	Percentage in Gas.	Net Heating Value, B.Th.U.
Illuminants . . .	2600	4·7	122·0
CO	326	6·9	22·5
H_2	275	36·9	103·0
CH_4	900	33·1	300·0
Net heating value per cubic foot (B.Th.U.) . .			547·5

(Net Heating Value of 3·17 Cubic Feet of Gases Produced by Burning 1 Volume of Gas and 2 Volumes of Air.)

Illuminants . . .	2600	0·9	23·4
CO	326	9·8	32·0
H_2	275	15·8	43·4
CH_4	900	2·8	25·2
Net heating value per cubic foot (B.Th.U.) . .			124·0

Net heating value from 3·17 cubic feet (B.Th.U.)	393
Solid carbon in 3·17 cubic feet = 0·0005 lb.	7
(B.Th.U.)	400
Net heating value of gas on complete combustion .	547 B.Th.U.
Net heating value of products of incomplete combustion	400
Heat liberated during incomplete combustion . .	147 B.Th.U.

Maximum Theoretical Temperature of Products of Combustion.

Constituents.	Volume in cubic feet.	Mean Specific Heat per cubic foot Interval 60°-2200° Fahr.	Heat Absorbed for 1° Fahr. Rise in Temperature.
H_2O	0·156	0·0245	0·0038
CO_2	0·025	0·0302	0·0007
CO-H_2-N_2 . .	0·782	0·0189	0·0148
CH_4-Illum. .	0·037	0·0540	0·0020
		(B.Th.U.) . . .	0·0213

Heat Absorbed by 3·17 cubic feet for a Rise in Temperature of 1° Fahr. = 3·17 × 0·0213 = 0·0675 B.Th.U.

Heat Available	147·0 B.Th.U.
Theoretical Combustion Temperature above Room Temperature . . .	$\frac{147}{0·0675}$ = 2180° Fahr.
Assume Room Temperature to be 70° Fahr. .	70° ,,
Theoretical Combustion Temperature . . .	2250° Fahr.

The net heating value of the gas is used in these calculations for temperature, since the water formed will escape from the furnace in the form of steam. The specific heats used are the mean specific heats per cubic foot for the range up to 2200° Fahr. The theoretical combustion temperature which can be attained when 1 cubic foot of cold gas is burned with 2 cubic feet of cold air is 2250° Fahr., as is shown in Table II. Still higher temperatures would be theoretically possible if the gases of incomplete combustion could be completely burned in a secondary operation and made to give up their heat to the incoming air.

The laboratory furnace as finally developed is shown in the illustration. The heating chamber is formed from a quartz tube into whose lower end is luted a Méker burner with connections by which both the air and gas supply can be metered. The rich gas mixture became heated as it rose through the hot quartz tube and ignited near the walls soon after reaching the hot zone. The heat of this initial combustion quickly ignited the remainder of the gas, so that by the time the mixture had risen half way in the tube combustion was complete, and the upper half of the tube was entirely free from flame. The pieces of metal were heated in these hot gases of controlled composition. As the gases passed out of the quartz tube, and turned to descend the annular space, more air was mixed with them, and the combustion completed as they passed down around the outside of the muffle. By this method the muffle was kept hot, and loss by radiation was prevented; and the rich gas mixture was brought to the kindling temperature very quickly by means of radiant heat from the muffle, so that a mixture which would not burn in an open flame could be burned easily. When burning a mixture of only two parts of air to one part of gas, a temperature of 2200° Fahr. could be easily maintained within the muffle.

The thermal efficiency of the furnace operated in this manner is indicated in Table IV, from which the following figures are taken:

Net Heating Value of Gas on Complete Combustion, 547 B.Th.U.

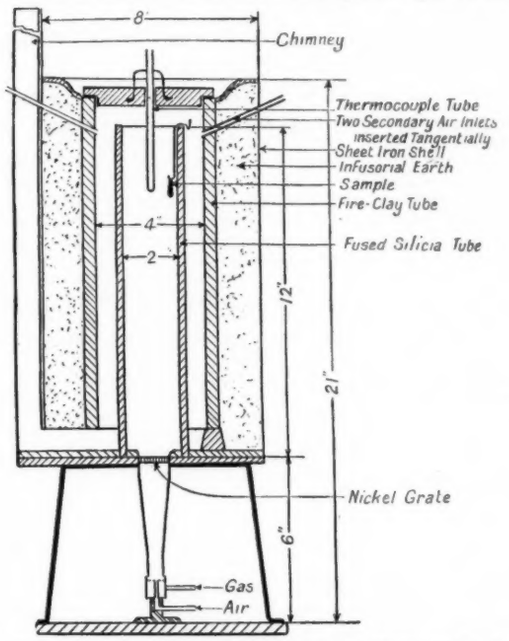
Net Heating Value of Products of Incomplete Combustion, 400 B.Th.U.

Heat Liberated during Incomplete Combustion, 147 B.Th.U.

Thus 147 out of the possible 547 heat units, or 27 per cent., were liberated in the primary combustion around the metal; and the remaining 73 per cent. were liberated in the secondary combustion around the muffle. No attempt was made on this small furnace to utilize the heat of the stack gases to preheat the primary air; but this might well be done in a large furnace with greater thermal efficiency and higher temperature during primary combustion. It would also be possible in this way to burn richer mixtures of gas and air than was possible with the small furnace.

In order to sample the gas within the muffle, it was necessary to cool the gases very rapidly, so as to avoid change in composition. A capillary quartz tube, with its upper part water-jacketed, was inserted through the hole in the cover to sample the gases. In this way there was a temperature drop of about 1830° Fahr. in one inch. From the capillary tube the gas was passed through a weighed calcium chloride drying-tube to absorb the water vapour, and then into a 2-litre gasholder, from which samples were taken for analysis by the usual methods.

Since the rapidity of oxidation is a function of the extent of surface of the metal, and it was desired to get as positive results as possible, the metal to be tested was used in the form of very fine wire. A piece of No. 34 soft iron wire (0·005 inch diameter), about 10 feet long, was wound into a small spiral and weighed. It was then hung on a hook of heavy wire and suspended in the upper part of the central tube of the furnace in the gases which had come to equilibrium in the lower part of the tube. This coil of wire was usually left in the hot furnace for an hour—an excessively severe test for such fine wire. Special precautions had to be taken in removing the hot wire from the furnace, as, if removed while hot, it would have become badly oxidized in the few seconds' exposure to the air. In order to cool it before taking out, a small piece of gas-pipe, with one end closed, was lowered into the furnace on a wire and the sample was placed inside.



Furnace Used for Studying the Action of Gas-Flames on Steel.

Here it was at once cooled by radiation to the cold walls of the pipe; and the pipe was removed before it had time to get hot. It is probable that even this method allowed slight oxidation, as a little air would be left in the pipe when the wire was put into it. After removing from the furnace, the sample was weighed and a colorimetric determination for carbon was made after the method outlined by Campbell and Haskins. ["Journal of the Iron and Steel Institute," 1913, II., p. 378.] The increase in weight represented the amount of oxygen absorbed to form magnetic oxide (Fe_3O_4). This oxide contains 2·61 parts of iron for each part of oxygen; so that an increase in weight of 1 per cent. means that 2·6 per cent. of the iron has been oxidized. This wire was very nearly 0·005 inch in diameter, and 1 lb. of it had a surface of about 20 square feet. If 25 per cent. of it were oxidized, the depth of penetration of the oxidation would be only 0·00035 inch and a 2 per cent. increase in weight (equivalent to 5·22 per cent. oxidation) would mean a depth of oxidation of only 0·00005 inch. So it is readily seen that a very slight thickness of oxide is easily measured. Since this wire contained initially only 0·04 per cent. of carbon, an analysis of the treated wire for carbon did not show the decarburization very accurately; so further tests were made on steel piano wire. The smallest size of steel wire at hand was No. 28, which is 0·014 inch in diameter. The colorimetric test showed about 1·25 per cent. of carbon before heating, but practically no carbon after heating for an hour at a temperature of 2100° to 2200° Fahr. Under these circumstances a 1 per cent. gain in weight meant a 2 per cent. gain in oxygen, since the wire lost about 1 per cent. of carbon during the heating process. This 2 per cent. increase in oxygen meant 5·2 per cent. oxidation, and corresponded to a depth of oxidation of 0·00175 inch. If the piece did not change in weight but 1 per cent. of the carbon was lost

TABLE III.—*Extent of Oxidation of Fine Iron and Steel Wires when Heated to 2200° Fahr. in Nearly Neutral Atmospheres.*

Test Number.	Weight of Wire in Grams.		Per Cent. Increase in Weight.	Calculated per Cent. of Fe Changed to Fe_3O_4.	Calculated Depth of Scale in Inches.	Ratio Air-Gas.	Mean Temperature ° Fahr.	Time of Heating.	Colour of Flame at Top of Muffle.
	Before.	After.							
A—Tests with Iron Wire 0·005 inch Diameter and Containing 0·04 per Cent. Carbon.									
3	0·3075	0·4200	36·5	95 5	0·002	2·5	2228	1 hr.	Colourless flame
4	0·3060	0·3645	19·1	50 0	0·00073	2·43	2100	35 min.	,, ,,
10	0·3010	0·3655	21·4	56·0	0·00084	2·40	2080	1 hr.	,, ,,
5	0·3050	0·3520	15·4	40 3	0·00057	2·25	2100	1 hr.	,, ,,
11	0·2995	0·3350	11·8	30 9	0·00043	2·20	2090	1 hr. 15 min.	Slightly coloured
8	0·3060	0·3320	8·5	22 3	0·00029	2·16	2170	2 hrs.	,, ,,
7	0·3045	0·3105	2·0	5·23	0·00005	2·08	2170	2 hrs.	,, ,,
6	0·3175	0·3185	0·3	0·78	0·00001	1·98	2135	45 min.	Yellow flame
9	0·3136	0·3073	1·2	3·14	0·00004	1·87	2220	1 hr.	,, ,,
12	0·2997	0·3007	0·3	0·78	0·00001	1·86	2100	1 hr.	,, ,,
B—Tests with Steel Wire 0·014 inch Diameter and Containing 1·25 per Cent. Carbon.									
14	0·2935	0·3017	2 79	10·60	0 00038	2·40	2080	1 hr.	Colourless flame
15	0 2995	0·3035	1·33	6·76	0 00029	2·20	2090	1 hr.	Slightly coloured
13	0·3745	0·3743	0·0	3·28	0·00012	1·87	2220	1 hr.	Yellow flame
16	0·3073	0·3065	− 0·26	2·60	0 0001	1 86	2100	1 hr.	,, ,,

and replaced by 1 per cent. of oxygen, then the depth of oxidation would be 0·0008 inch.

EFFECT OF HEATING MILD STEEL IN A NEUTRAL ATMOSPHERE.

Data regarding tests on the fine iron wire with 0·04 per cent. carbon are given in Tables III. and IV. It will be noted that the tests are excessively severe; the fine iron wire being directly exposed to the gases at temperatures of 2100° to 2200° Fahr. for thirty-five minutes to two hours. The figures in Table III. are arranged according to the volumes of air used for one volume of illuminating gas. With 2·5 volumes of air to 1 volume of gas the fine iron wire is, after an hour's heating, converted almost completely into oxide, and with 2·4 volumes of air the oxidation, as shown by the increase in weight, amounts to 56 per cent. [Experiment No. 10]. However, with this fine wire, even this high oxidation gives a film of oxide only 0·0008 inch in thickness—a thickness totally negligible in any ordinary work. The composition of the gases surrounding the wire while being heated is shown in Table IV. The oxidizing agents—consisting of carbon dioxide, steam, and a trace of oxygen—amount in Test No. 10 to 18·3 per cent., and the reducing agents—consisting of carbon monoxide and hydrogen with a small percentage of methane—amount to 27·8 per cent. The ratio of the reducing gas to the oxidizing gases is 1·52.

TABLE IV.—*Gas Analyses.*

—	Average for Illuminating Gas Used.	Composition of Gases After Partial Combustion.				
Test No.		5	6	7	10	12
H_2O (vapour)	3·1	14·6	15·6	14·7	15·5	13·9
CO_2	1·8	3·2	2 5	2·8	2·6	2·0
Illuminants	4·7	0	1·0	·6	·0	·9
O_2	1·0	·0	·0	·2	·2	·2
CO	6·9	12·3	10·8	12·7	13·1	10·6
CH_4	31·1	·9	2·4	1·2	2·8	2·9
H_2	36·9	12·5	17·6	19·4	12·9	17·5
N_2	12·5	56·5	50·1	48·4	52·9	52·0
Temperature		2100° F.	2135° F.	2170° F.	2080° F.	2100° F.
Ratio $\frac{\text{Air}}{\text{Gas}}$		2·25	1·98	1·90	2 40	1·86
Sum oxidizing agents, CO_2, H_2O, O_2		17·8	18·1	17·7	18·3	16·1
Sum reducing agents, H_2, CO, illuminants, CH_4		25·7	31·8	33·9	27·8	31·9
Ratio $\frac{\text{Reducing agents}}{\text{Oxidizing agents}}$		1·45	1·76	1·91	1·52	1·98

With slightly richer gas mixtures, the oxidation (even as shown by the sensitive test of increase in weight) becomes very small. When less than two volumes of air were mixed with one volume of this gas, the flame in the inner muffle became distinctly yellow. This seemed to be a fairly good indication that oxidizing conditions had disappeared, for the three samples of wire (Examples Nos. 6, 9, and 12), heated under these conditions, showed almost no increase in weight and no brittleness on bending, and retained their silvery metallic lustre. The analysis of the gases from the muffle showed the ratio of reducing to oxidizing gases in these tests to be from 1·76 : 1·98.

It was stated in the earlier part of the paper that the work on carbon monoxide had shown that, in order to prevent oxidation of iron, it was necessary to have more than five times as much CO as CO_2 present. With the products from the incomplete combustion of illuminating gas which contain small amounts of hydrocarbons and material amounts of hydrogen, conditions seem much more favourable.

EFFECT OF HEATING HIGH CARBON STEEL IN A NEUTRAL ATMOSPHERE.

The steel wire used in these tests contained 1·25 per cent. carbon, and was 0·014 inch in diameter. When heated to 2000° to 2200° Fahr. for one hour, under conditions similar to those used for the soft iron wire, it was found that oxidation of the metal could be prevented as with the soft iron wire, but that decarburization could not be prevented. In every experiment at these high temperatures, practically all the carbon was removed from the metal. This would mean that the decarburization after one hour at this temperature had progressed at least 0·007 inch from the surface. This is not altogether unexpected, since hydrogen (as well as carbon dioxide and steam) acts as a decarburizing agent. The rate of decarburizing would certainly be slower in this gas than in ordinary furnace operation; and, by the use of still smaller amounts of air, decarburization might be altogether prevented, since case-hardening may be produced when pure illuminating gas is used. There should be no difficulty in preventing decarburization at the lower temperatures used in the heat treatment of steel. The details of these tests on steel wire are given in Part "B" of Table III.

SUMMARY.

It has been shown that it is entirely possible to heat pieces of iron and steel, even to a forging temperature, in an internally fired muffle without any oxidation or formation of scale on the surface of the metal. A neutral atmosphere of this type is produced when approximately one volume of illuminating gas is made to combine with two volumes of air. This mixture is so rich that it will not burn unless preheated. This atmosphere, although neutral to iron, decarburizes steel slowly at forging temperatures. It acts as a much less active decarburizing agent at this temperature than the ordinary furnace atmosphere, and may be rendered less active by using a mixture still richer in gas. At the lower temperatures employed in heat treatment, gas of this composition would cease to exert a decarburizing action.

It should be entirely feasible to make a commercial application of this process. The heat evolved by the primary combustion within the muffle is about 27 per cent. of the possible total heat, and is sufficient to give a theoretical combustion temperature of 2200° Fahr. when starting with cold gas and cold air. A secondary combustion around the muffle aids in keeping up the temperature, so that there is no trouble in actually realizing the temperature of 2200° in a muffle. This secondary combustion liberates all the heat units in the gas, and so raises the thermal efficiency. If the sensible heat of the waste gases should be used to preheat the entering air, a high efficiency could be obtained. When starting with a cold furnace, the full amount of air for complete combustion could be introduced into the gas burning within the empty muffle, which could thus be quickly and efficiently brought to a working temperature. The primary-air supply could then be reduced to the desired amount, and the metal introduced into the muffle where—being directly exposed to the neutral gases—it would be more rapidly heated than in an externally heated muffle, and would still be protected from oxidation. The saving in metal should be considerable, and would probably compensate for any increase in the cost of fuel. The process presents attractive possibilities in its application to the automobile industry and other industries where quality is paramount.

DEVELOPMENTS IN THE DOHERTY WASHER-COOLER AS A GAS-CONDENSER AT DETROIT.

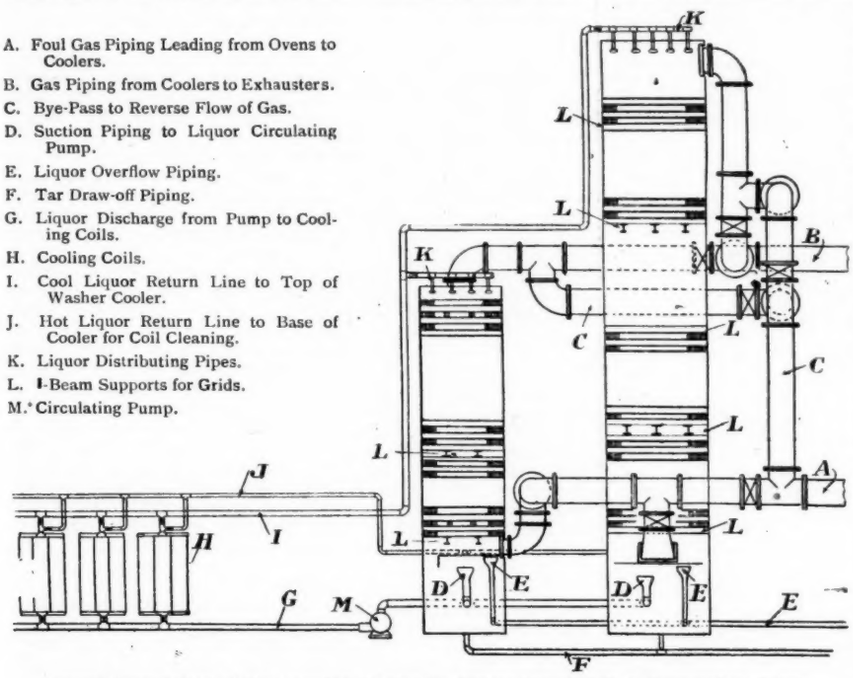
By Robert B. Rowley.

[A Paper read before the Michigan Gas Association, Sept. 23.]

In 1907, Mr. W. Seymour favoured this Association with a paper entitled "A New Method of Condensing and Scrubbing," in which he described the first installation of a Doherty patent washer-cooler as a coal-gas condenser at Grand Rapids. Briefly, this type of apparatus consists of a device whereby the crude gas is brought into direct contact with a supply of cooling liquor, which cools the gas and at the same time washes out mechanically those substances which are separated during the cooling. The liquor is then cooled in coils, and returned to the gas compartment for further use.

The installation referred to consisted of an apparatus divided into eight compartments, through which the gas passed alternately up and down. This resulted in a parallel current of gas and liquor in four compartments and a counter-current flow in the other four. Each compartment was equipped with a circulating pump and a set of cooling coils; and a separate liquor circulation was maintained in each.

Four years later, Mr. L. E. Worthing presented to the American Gas Institute a paper entitled "Some Principles of Condensation with Especial Reference to Water Gas." In this paper he gave a description of a washer-cooler which was being used by the Detroit City Gas Company as a water-gas condenser. This apparatus consisted of a three-compartment unit in which the gas passed upward in each compartment, making a counter-current flow of the gas and liquor throughout. A separate pump and a separate circulation were also used on each compartment with this water-cooler. With this installation, the cooling was reduced to triple stage.


A. Foul Gas Piping Leading from Ovens to Coolers.
B. Gas Piping from Coolers to Exhausters.
C. Bye-Pass to Reverse Flow of Gas.
D. Suction Piping to Liquor Circulating Pump.
E. Liquor Overflow Piping.
F. Tar Draw-off Piping.
G. Liquor Discharge from Pump to Cooling Coils.
H. Cooling Coils.
I. Cool Liquor Return Line to Top of Washer Cooler.
J. Hot Liquor Return Line to Base of Cooler for Coil Cleaning.
K. Liquor Distributing Pipes.
L. I-Beam Supports for Grids.
M. Circulating Pump.

General Arrangement of the Lean-Gas Condensing System (Semet-Solvay Company) at Detroit.

In 1910, Mr. W. S. Blauvelt presented a paper to this Association, in which he described an installation of washer-coolers used as coal-gas condensers at the Detroit plant of the Semet-Solvay Company, which Company hold the rights for this type of apparatus in the coke-oven field. These washer-coolers were put in operation about the same time as the three-stage apparatus installed by the Detroit City Gas Company, and were intended to operate in two stages—that is, the cooling was done partly in a primary cooler and completed in a secondary unit. The installation required only two circulating pumps and two separate liquor circulations; and the cooling was reduced to double stage.

In the few years since the installation of the first Doherty washer-cooler at Grand Rapids until the adoption of two-stage cooling by the Semet-Solvay Company at Detroit, the system had been reduced from an apparatus cooling in eight stages to a system using only two. Since 1910, the capacity of the Detroit plant of the Semet-Solvay Company has been increased, by steps, from 1200 tons to 2400 tons of coal daily. In order to increase the capacity of our condensers, and to better handle apparatus cleaning arising from this increase in output, the two-stage system has gone through a further simplification, and has been remodelled into a single-stage system, in which all the cooling of the gas is performed in one operation in a single unit. It is the purpose of this paper to show some of the reasons why this change was made, and to give a brief outline of our condensing system and its operation as it now exists.

At the Detroit plant, the gas coming from the ovens during the first part of the coking period [rich gas] is kept separate from that evolved during the latter part of the coking [lean gas], which is used for fuel at the plant. This makes necessary the installation of independent cooling and scrubbing apparatus for the rich and the lean gas. With normal operation both the rich and lean gas leave the hydraulic main practically saturated with water vapour. As the operation is on a very large scale, the effect upon the total gas output of fluctuations caused by charging and discharging one oven is very trifling; and the temperature of the gas entering the coolers varies but slightly from day to day, and only a few degrees from season to season. For this reason, it is possible to determine accurately the amount of heat that must be removed for a definite quantity of gas entering the washer-cooler at any given temperature.

With the washer-cooler and the direct contact method of cooling, using the counter-current flow, a maximum heat transfer is obtained by bringing the temperature of the gas leaving the top of the cooler to the temperature of the cooling liquor entering, and by bringing the temperature of the liquor leaving at the bottom of the apparatus as closely to the temperature of the gas entering as is possible, without endangering the positiveness of the cooling in case of an increase in the output.

When operating a washer-cooler in this way, it is only necessary to supply a volume of cooling liquor capable of absorbing the heat of vaporization of the condensable vapours carried by the gas, which from a thermal standpoint consist chiefly of water vapour, and to cool the gas itself. Since the condensate and circulating liquor leave the bottom of the cooler almost at the temperature of the gas entering, little cooling of the condensate is required within the column. Although the condensate which separates near the top is cooled, it is again heated before separating from the gas.

The quantity of heat which it is necessary to abstract per minute to cool from various temperatures one million cubic feet per day of gas saturated with moisture is shown graphically by the author. The gas volume is corrected to 0° C. and 760 mm Hg saturated with moisture. The figures include the quantity of heat it is necessary to abstract from the gas to lower its temperature and the quantity which must be removed in order to condense the water vapour. It does not include, however, the heat removal necessary to lower the temperature of the condensate to the lower temperature, as this is not done in the washer-cooler itself, when operated in the way already described. The heat removal required to condense the hydrocarbon vapours carried by the gas has been neglected, as it is a very small percentage of the total heat.

The figures were calculated from a table of data prepared by Mr. Herbert A. Humphrey, and published by him in the "Proceedings of the Institute of Mechanical Engineers" for 1900. This table gives data covering the characteristics of saturated gases between 0° to 100° C. (32° to 212° Fahr.). The figures have also been checked against the actual practice, and agree very closely with the actual heat removal.

From the curve it is seen that the thermal capacity of gas when saturated with moisture is much greater per degree change of temperature at the higher temperatures, and that the quantity of heat to be removed per degree of cooling becomes greater at a continuously increasing rate as the temperature rises. The author remarks: For our work it is not necessary to consider gas at a temperature above 85° C. (185° Fahr.), although the recent tendency toward faster coking times and higher oven temperatures tends to increase the temperature at which the gas enters the condenser. If the gas enters the cooler saturated with moisture at 85° C. (185° Fahr.), it is seen that 47,000 B.Th.U. must be removed per minute to cool a million cubic feet of gas per day to 0° C. (32° Fahr.) and condense the water vapour. About 43,000 B.Th.U. will be removed, however, when the gas temperature has been lowered to 42·5° C. (108·5° Fahr.), or through half the drop in temperature desired. In other words, 91·5 per cent. of the total heat is removed in cooling the gas to 42·5° C. (108·5° Fahr.) through only 50 per cent. of the temperature drop.

It is also seen that in this system of cooling the capacity of any quantity of liquor for cooling depends almost entirely upon the range of temperature change through which it can be made useful. If heated from 42·5° to 85° C. (108·5° to 185° Fahr.), a certain quantity of liquor can absorb only 50 per cent. as much heat as the same quantity when heated from 0° to 85° C. (32° to 185° Fahr.).

Because of the varying quantity of heat that it is necessary to abstract, in order to cool a certain quantity of gas 1° at the different temperatures throughout the cooling, and because of the very small heat removal necessary at low temperatures, considerably less cooling liquor is required to cool a definite quantity of gas between temperatures of low range than through those of short range, when cooling from the higher temperatures.

A curve was also constructed to show how this feature affects the quantity of cooling liquor required in a washer-cooler to cool gas saturated with moisture to the temperature of the cooling liquor entering the column with the liquor leaving the column at the temperature of the gas entering. These calculations have been made with the assumption that a perfect heat-exchange is obtained in the column and that the maximum cooling capacity of the liquor is utilized. In actual practice this is, of course, not obtained. It is easily possible, however, to keep the temperature of the liquor leaving the cooler within 5° C. (9° Fahr.) of the temperature of the gas entering. When cooling from 82° to 27° C. (147·6° to 48·6° Fahr.) with this difference, the cooling range in the gas extends 55° C. (99° Fahr.), while that of the liquor only 50° C. (90° Fahr.). This reduction of the range through which the liquor is heated causes a correspondingly larger quantity of liquor to be used in practice than is shown on the chart—depending upon how closely the gas can be brought to the temperature of the cooling liquor as the temperature of the liquor leaving is brought closer to the temperature of the gas entering. With the liquor leaving 5° C. (9° Fahr.) below the temperature of the gas entering, under the conditions mentioned above, about 90 per cent. of the maximum cooling capacity of the liquor is being used, and the actual circulation can be calculated from the theoretical by use of this factor.

Reference to another curve shows that a cooling circulation of 64·5 gallons per minute is required to cool a million cubic feet of gas per day measured at 0° C. and 760 mm. from 85° to 40° C. (185° to 104° Fahr.). In this case the cooling liquor would enter the washer-cooler at 40° C. (104° Fahr.) and leave at 85° C. (185° Fahr.), or would be heated through a range of 45° C. (81° Fahr.). If the cooling were to be done between 0° and 85° C. (32° and 185° Fahr.) by liquor entering at 0° C. (32° Fahr.), a circulation of 37 gallons per minute would be sufficient. To cool the same quantity of gas through a range of 85° C. (185 Fahr.) requires only 57·5 per cent. as much liquor as is needed when cooling through a range of 45° C. If this same quantity of gas were cooled from 85° C. (185° Fahr.) to 60° C. (140° Fahr.) by liquor entering at 60° C. (140° Fahr.), a cooling circulation of 85·4 gallons per minute would be necessary.

Let us now consider, the author resumes, the thermal conditions within the cooler itself. The following table shows the quantity and percentage of heat removed per minute from gas saturated with moisture at 85° C. at the rate of a million cubic feet per day measured at 0° C. and 760 mm., when cooled to lower temperatures.

Gas at the Rate of a Million Cubic Feet per Day Measured at 0°C. and 766 mm.

Temperature to which Gas is Cooled from 85° C. (185° Fahr.). °C.	°Fahr.	Heat Removed per Minute B.Th.U.	Percentage of Heat 0°C. (32° Fahr.) Removed When Cooled to Lower Temperature.
80	176	15,386	32·6
70	158	30,288	64·2
60	140	37,320	79·1
50	122	41,205	87·5
40	104	43,517	92·3
30	86	44,984	95·4
20	68	45,952	97 5
10	50	46,614	98·9
0	32	47,122	100·0

As the cooling liquor entering at the top descends through the column it becomes heated, and in turn cools the gas which is passing upward through the column. When cooling a fixed quantity of gas between certain temperatures with a definite quantity of liquor, it is a matter of simple calculation to show the change in temperature of the liquor as compared with that of the gas. This has been done for a washer-cooler when operating under various conditions; and the results are plotted in a third diagram.

This shows that at the top of a cooler working with a perfect heat exchange, the temperatures of the gas and liquor are the same. As the liquor flows downward through the apparatus, the thermal difference increases until it reaches a maximum in the part of the apparatus where the gas temperature is from 60° to 70° C. (140° to 158° Fahr.), depending upon what range the cooler is working through. With a washer-cooler between 20° and 85° C. (68° and 185° Fahr.), the difference in temperature between the gas and liquor increases from 0° at the top of the washer-cooler where the temperature of both the gas and liquor is 20° C. (68° Fahr.) to a maximum of 28·5° C. (83° Fahr.) at the part of the column where the gas is 65° C. (149° Fahr.), and then falls to 0° again at the base of the column where the temperature of both the gas and liquor is 85° C. (185° Fahr.).

At the Detroit plant, the average temperature of the gas entering the coolers runs a little over 80° C. (176° Fahr)., and the cooling problem consists in cooling this gas to a temperature varying from 15° C. (59° Fahr.) in the winter to 27° C. (80·5° Fahr.) in summer. As the output increased, it became more and more difficult to properly cool the gas; and after due consideration of the above principles, and more especially to relieve stoppages in the secondary lean condenser and secondary rich and lean cooling coils, it was decided to try single condensation.

Accordingly, the cooling coil installation was changed from the old two-stage system to a new arrangement, which allows a straight passage through double pipe cooling coils, and the liquor cooling to be done in one operation. The cooling coils are double pipe coolers of the same type as those described by Mr. Blauvelt in 1910. In these the cooling liquor flows through the annular space between a 2-inch and 3-inch pipe with water passing both through the inside of the 2-inch and over the surface of the 3-inch pipe.

Since all the cooling has been done in the one washer-cooler, very little liquor or condensate separates from the gas at a low temperature. All the condenser liquor leaves at a temperature above 158° Fahr., and is comparatively clean. Experience has been that the tarry matter and suspended naphthalene separate much more readily from liquor at a high temperature than at a low temperature. Because of the higher temperature at which the liquor separates from the tar in the single-stage system, the liquor going to the cooling coils is much cleaner than it was when coming from the secondary condenser with the two-stage system. This has resulted in much less trouble with naphthalene deposits in the cooling coils.

The washer-coolers used in this service until recently were the old primary coolers described by Mr. Blauvelt in 1910, with an additional 5 feet of gridding. One of these coolers has been used for the lean gas and one for the rich. Since the capacity of the plant has been increased to more than 2000 tons daily, the lean cooler has been overloaded during summer weather, and a new unit has been built to handle the lean gas—the old unit being retained as a spare to be used when the new cooler is being cleaned. This new washer-cooler has been designed to allow a maximum heat absorption by the cooling liquor and to bring the temperature of the gas leaving to the temperature of the liquor entering the column. The general arrangement of the new lean cooling system is shown in the illustration.

This new washer-cooler was only erected during the past summer, and has not been in operation sufficiently long to present any accurate data from its operation. The old coolers as single-stage washers have given very good results when not overloaded, and have verified the conclusions which were reached theoretically from the curves given in the paper.

With single-stage condensation as practised at Detroit, all the tar which is taken from the gas in the condensers is removed from contact with the gas at the highest temperature that exists within the condensing system.

It would also seem that with the new single-stage cooler the condensing process is being conducted in as short a time as present knowledge and equipment will allow. In the "Proceedings" of the Association for 1911 is the following statement by Professor A. H. White and R. S. Tour: "Would the candle power or heating value be injured by rapid cooling? The answer is quite certain that they would not. The more benzol retained in the gas the better. The quicker the tar is removed from the gas, and the higher the temperature at which it is removed, the better will be the candle power and heating value of the gas." The experience to date at the Detroit plant bears out this statement.

Conclusion.

To sum up, the substitution of single-stage for double-stage condensation has allowed the separation of all the condenser tar at a point of highest temperature and in an extremely short time.

It has permitted the elimination of two washer-cooler units from the condensing system, and a corresponding reduction in the pumping equipment of two units. The same pumps which previously provided the primary circulation took care of the single-stage coolers, even with the increased load, until the construction of the new lean washer-cooler with its increased height.

The use of steam has been eliminated as a means of coil and apparatus cleaning—its function now being performed as a matter of routine by the heat and tar carried by the crude material itself.

And, finally, the move has been a simplification, and has resulted in a clearer understanding of, the apparatus and its operation by the operating force, which, in turn, has reacted to give uniform and more satisfactory results.

Heating Water in a Holder to Prevent Freezing.—It was suggested to the Committee on Manufacturing of the Iowa District Gas Association that among the matters to which they should give special attention might be the most economical way to heat the water in a holder in a small plant, to prevent freezing. They accordingly took up the subject, and have reported as follows: The amount of waste heat that is practically a total loss in any water-gas plant is enormous. There is no better way to prevent a holder from freezing than by using some of this waste to heat water, and circulate it from the tank or pit through the heater or condenser back to the cups and tank. In a plant where water gas is not made continuously, it would be necessary to provide steam syphons also. The plan of using the water from the holder-tank for cooling in the water-gas condenser, and at the same time heating the water in the holder-tank, has been tried successfully at the Davenport Gas-Works. When using steam-syphons, care must be taken that they are constructed properly. The idea of using a syphon is to get a good circulating movement in the water.

DISTRIBUTION EXTENSIONS AND ALTERATIONS.

By J. D. Luck, of Markinch.

[A Paper read before the Scottish Junior Gas Association (Eastern District), Oct. 16.]

In his paper, the author dealt with alterations and extensions by his Company during the past sixteen months. He said that on his appointment as Manager of the Markinch Gas Company in the early part of 1914, it was decided to carry out an extension of the mains to the village of Coaltown of Balgonie. In addition to the supplying of this new district, it was found necessary to make certain improvements on the mains in Markinch, owing to insufficient supply. In the main street in Markinch, it was found that there was an insufficient supply for the increasing demands on the main; and he at once saw the urgency of an efficient supply being given before the advent of another lighting season. Though the greatest demand for gas came from the High Street, there was a general complaint of poor supply all over the town. This had to be overcome without further delay, in addition to the extension of the gas supply to Coaltown of Balgonie.

As to the supply for Coaltown of Balgonie—a village three miles from Markinch, consisting of one main street with branch streets off, formed by rows of colliers' houses and a few cottages and shops, with a school and a large hall—it was expected that about three-fourths of the householders would ultimately take gas, this being 165 in number. However, by a personal canvas made later, he was able to bring up this number to nearly 200. In drawing up the estimate for the scheme, however, the number of consumers was put down as 165.

For supplying the village, the question of available pressure was a very serious one, the altitude at Coaltown being practically level with the works; and as they were already faced with an insufficient supply at Markinch, it was absolutely essential to safeguard against want of pressure in the new district. He therefore went into the question of an entire low-pressure scheme, embracing the Markinch supply, and of a combined high and low pressure scheme giving an independent supply to Coaltown of Balgonie. To improve the Markinch supply, it was proposed to take up 300 yards of 6-inch main, running from the works, and substitute a 10-inch one; the 6-inch pipe to be utilized to replace a 2½-inch pipe in the High Street. The estimated costs were entirely in favour of a combined high and low-pressure system for Coaltown of Balgonie, and the substituting of pipes of a larger diameter in Markinch; the estimate for this complete scheme being £1824, as compared with £2157 for the low-pressure scheme.

Now that the scheme was decided on, it was necessary to arrange how the work of laying the main and service pipes should be carried out. Being a small undertaking, they had not, of course, a staff of fitters at hand; and it was decided to contract this part of the work, making the contractor entirely responsible for both the digging of the track and the laying of the pipes. In drawing out the specification, the scheme was divided into three sections. No. 1 section included the taking out of the 6-inch pipe from the holder to the branch-piece, 300 yards up the road, and substituting a 10-inch pipe—the 6-inch pipe to be laid aside and used later. The 4-inch high-pressure main to be laid from the works up to the same point. No. 2 section included the continuing of the high-pressure main along the High Street, to take the place of the existing 2½-inch pipe. No. 3 section included cutting the track and continuing the 3-inch high-pressure main to Coaltown of Balgonie, also laying the low-pressure mains in the village. It was decided to adopt Mannesmann pipes, with rigid or long-sleeve joints; his recommendation of Mannesmann pipes being influenced mainly by his own personal experience of them elsewhere. The long lengths, and consequent saving of joints, were their great advantage. All the jointing on the high-pressure main was to be done with lead wool.

In No. 1 section, two ways were open to execute the work of taking out the 6-inch main and replacing with the 10-inch. The methods were to disconnect at the holder and lay in a temporary pipe 50 yards up, allowing the town to be supplied with gas while the first 50 yards was being connected by the new 10-inch main; or to open up the whole track for 300 yards and connect-up in one day, cutting off the gas supply for the time being. The latter was the plan adopted. Notices were posted up throughout the town, and, in addition, a postcard written to each of the large consumers who were entirely dependent on gas for power, intimating that the supply would be cut off from 7 a.m. till 6 p.m. The day selected was a Wednesday—the local half-holiday. The track was opened for the whole 300 yards, and all the services bared about a yard back from the main, to allow them to be reconnected to the new pipe. There was good weather, and this enabled them to have the whole section completed in one day, and the gas turned on again at the hour promised.

Passing on to No. 2 section, this dealt with the continuing of the 4-inch high-pressure main and the taking out of the old 2½-inch pipe in the High Street, to be substituted by the 6-inch pipe lifted. It would be noticed the high-pressure main again entered the track alongside this 2½-inch pipe. In the course of his preliminary investigations, the idea of boosting-up the mains in Markinch suggested itself to him. This would have saved the necessity of altering any of the Markinch pipes, had it been possible. Circumstances, however, compelled him to abandon such a proposal. He was made aware of the faulty condition of this 2½-inch pipe by systematic piercing, and, on baring it, found it to be in a very bad and leaky condition. The pipe was laid in 1874. It was also found to be lying with only 18 inches of cover, and in some parts less. This meant the deepening of the track for the new pipes, as the amount of cover had to be not less than 24 inches from the top of the pipe—the High Street being usually a busy thoroughfare. On this section there were about 80 services to disconnect from the 2½-inch pipe and re-connect to the 6-inch pipe. To put the consumers to as little inconvenience as possible, they arranged to open-up and disconnect 50 yards daily. As they now had gas coming from both directions of the main—the gas circulating from the street running parallel, and being connected to the High Street pipes at both ends—consumers were only affected on the day their section was disconnected, and then merely for a few hours.

Starting from the branch-piece at the east end of the High Street, 50 yards of pipe were bared, and the track made broad enough for the reception of both pipes. The 2½-inch pipe was cut-out for a distance of 25 yards and laid aside; a temporary plug being put in the end of the 2½-inch main in the track. The fitters had three lengths of 6-inch pipe jointed together, ready with the holes bored and tapped for the service connections. This saved considerable time, and allowed one of the fitters to bore and tap the pipes before lowering into the track. Each forenoon the labourers opened up 50 yards to prepare the way for the fitters the following day. The afternoon work of the labourers consisted of filling-in the track of the finished work done by the fitters. In this way, only 50 yards of track at a time were left open overnight; and no exception could be taken to this distance by the local authorities. This was an important point which had to be considered when operations of the kind were being carried out on a county thoroughfare.

On this stretch of main there were several old 1-inch cast-iron services crossing the road to supply consumers on the other side of the street. As they had in some cases only about 12 inches of cover, it was necessary to improve these. It was not possible to have the services bared all the way at this time, which would have meant blocking the thoroughfare; but these cases he noted, and had replaced by malleable iron later. This enabled them to lower the services all the way, and thereby run no risk of broken services later, as the county authorities were waiting for them to finish their job before they commenced to improve the surface of the roads.

Unfortunately, operations were brought to a standstill for a few days at this stage, owing to a strike at the works of the British Mannesmann Tube Company in South Wales; and later on, at the outbreak of the war, delay was again experienced owing to lack of proper waggons for transporting the pipes. When the pipes arrived, No. 3 section was proceeded with. The 3-inch main joined the 4-inch high-pressure main at the point crossing the railway bridge, and continued to a spot where a 2-inch reducing governor was fixed, controlling the supply to 38 houses. Then it went on to Coaltown of Balgonie; a governor being fixed to control the supply to the village. The high-pressure main being completed, the whole stretch from the works to the village was put under test. The main was subjected to a pressure of 10 lbs. per square inch by means of the compressor erected at the works. The pressure was sealed in the main, and allowed to remain overnight. As was the case with sections Nos. 1 and 2, this section was most satisfactory.

As to the low-pressure mains and services in Coaltown of Balgonie, the 4-inch main ran along the entire length of the village on the north side of the main street, and under the footpath; and they had decided to run a 3-inch pipe along a portion of the south footpath. This enabled them to put in all the services without having to cross the macadamized road. For the services, the Gas Company provided all the malleable iron piping and fittings, which varied from ¾ inch to 1½ inches bore. They also supplied service saddles, stopcocks, and compo. pipe for connection to the meter-inlet. The contractor supplied the labour, tools, tackle, red lead for jointing purposes, holdfasts, and solder for the completion of the work. The malleable iron pipe saddles adopted were found most satisfactory for the Mannesmann tubes. For the fixing of these saddles it was necessary to strip the covering all round the pipe. The main being bored and the service saddle fixed, the connection was carefully wrapped over with the canvas provided for the purpose, and soaked in tar. Each service-pipe was laid with a gradual rise towards the building, and had at least 10 inches of cover. In every case, the shortest route possible was taken, and bends used in preference to knees and elbows. The service-pipes were laid on and carried to a wall-shelf for the meter, previously fixed by the proprietor. These shelves were fixed in the sculleries, at a convenient corner, thus allowing the Company to fix cooking appliances later and ensure a good supply. Where it was possible, one service-pipe was laid of sufficient size to supply two or more attached houses. If it was found necessary to carry the service-pipe across the face of the plastered walls or through partitions, &c., compo. pipe was used, and any damage done to the plaster work made good to the satisfaction of the proprietor.

The smallest services put in were ¾-inch; the stopcocks being ¾ to ½ inch. The ¾-inch female end was fixed to the service-pipe just inside the walls; and to connect to the meter-inlet 2 feet of compo. pipe was required.

With regard to carcasing, the majority of the houses were two or three roomed, with scullery behind. The pipe from the meter was ½-inch compo. past the first branch-off in the kitchen, which

was ⅜-inch compo. A ⅜-inch pipe continued off the ½-inch pipe to the rooms. The scullery branch was taken off the ½-inch pipe at the meter. In order to have the pipes exposed as little as possible in the various rooms, they recommended the putting in of a hatchway in every house. In some cases, however, it was possible to utilize a hatch for two houses. The hatchway enabled them to get advantage of the space between the room ceilings and the outside roof. It also enabled the work to be carried out in a more satisfactory manner than exposing all the internal pipes on the face of the wall. The only pipes shown were the lengths between the kitchen and room brackets to the ceiling.

The majority of the consumers in Coaltown of Balgonie use slot-meters, and it was resolved to adopt one maker's meter only; the same padlock being used for every meter. They early found the advantage of this policy. In common with other gas undertakings, they were recently compelled to raise the price of gas. This meant altering the change-wheels on the slot-meters; and it would at once be seen how easy a matter it was to make the necessary change. It was regrettable that so many meter makers had a different pattern of change-wheel. If it were possible to standardize these wheels as well as meter-unions, it would be a great boon to gas undertakings.

So far, the scheme had turned out very successfully. The make for the year ending April 30 showed an increase of fully 2½ million cubic feet, or 28 per cent., over the previous year. The complaint of poor supply from Markinch consumers was a thing of the past; and the new district was well served with an up-to-date and most efficient supply.

Concluding, he said the Markinch scheme, with which he had dealt, cost £2411, being £117 over the estimated outlay—caused through the increased number of consumers.

DISCUSSION.

The PRESIDENT, in thanking the author, said the subject was one of great interest to juniors, because they had to supervise or do such work.

Mr. MOYES congratulated Mr. Luck on the actual cost of his scheme being so near the estimate.

Mr. J. B. SCOTT said he did not know any Scottish district where there was more of this sort of work than Fife. In Fife, villages had sprung up repeatedly in past years, and such jobs cropped up again and again—not only once in a lifetime. Sometimes one talked of high pressure when only meaning from 2 to 2½ lbs.; but high pressure was more than using the booster to pump out the gas. Regarding the tapping of the main, which was very important, in his own district they followed two ways. For some years they had been using the Parkinson and Woodall expanding nipple; latterly they had been trying Mr. Luck's method. Personally, he preferred the expanding nipple, especially in districts where underground workings were troublesome.

The PRESIDENT asked Mr. Luck if, on cutting a steel pipe, he found in the middle of the pipe where he cut, after filing the edge, that he could not get the centre cut piece to enter the faucet.

Mr. LUCK, in reply, said he had no difficulty in this way with the Mannesmann pipe.

The PRESIDENT proposed a hearty vote of thanks to Mr. Luck [which was accorded]; and the proceedings concluded after the members had examined some specimens of pipes and couplings which Mr. Luck explained.

LIMELESS CONCENTRATION OF GAS LIQUOR.

By JOHN S. UNGER, of Chicago, Ill., U.S.A.

[From the "Gas Age," New York, Oct. 1.]

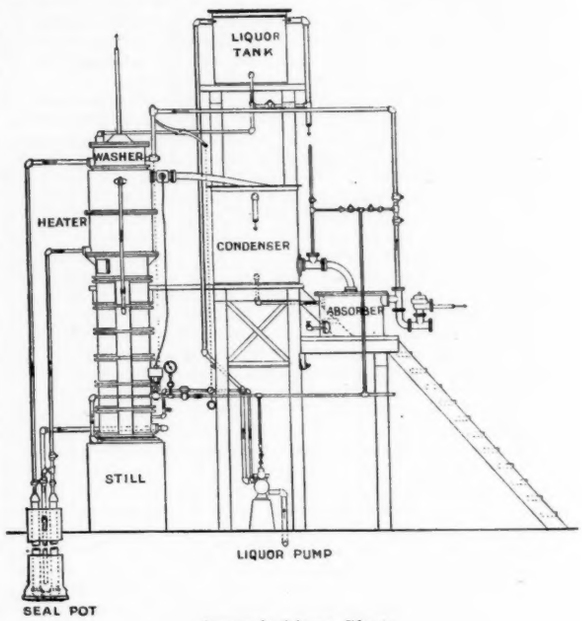
To many managers of small coal-gas works, the question as to whether gas liquor should be saved, and the condensing and scrubbing system so manipulated that it would pay to concentrate the liquor, also whether an ammonia still could be operated with the present labour in attendance at the works, seem beset with so many difficulties that a valuable bye-product is allowed to go to waste, even in works carbonizing as much as 8000 tons of coal per annum. Other gas managers are more courageous, and instal ammonia stills in works with a yearly carbonization record of only 3000 tons. While in some of these works the ammonia still soon ceases to be either ornamental or useful, this article is written in order to encourage the installation of stills in small gas-works for the recovery of only the free ammonia, but so arranged that a lime leg and an additional sections can be added, for the recovery of the total ammonia, when the works grow larger.

Necessarily, the ammonia losses in small gas-works will be high in proportion to the total ammonia in the gas, more especially in warm climates. But, in the more temperate zones, with cool condensing and scrubbing water, these losses can be limited to the ammonia lost by evaporation and the liquor lost in defective joints and pipes. In other words, the works will have to be carefully operated in order to get good ammonia results; and in this respect it is said that small gas-works are at a disadvantage, owing to lack of skilful attendance, and to the multitude of duties devolving upon a small number of men. But, otherwise, smallness should not stand for inferiority. It is just the ammonia recovery which would give an ambitious manager the opportunity to show his ability.

Going into ammonia recovery means a more careful use of water in the hydraulic main and in the scrubber, and a circulation of weak ammoniacal liquor through the first scrubber or washer. This liquor can be supplied from the same pump that feeds the ammonia still. In regard to feeding the second scrubber with cold water, it is necessary to flush the scrubber at time-intervals; otherwise the distribution of the water in the scrubber would be defective. The flushing can be done with an ordinary 5-gallon automatic flushing tank, as used by plumbers.

The amount of fresh water entering the system will determine the strength of the weak liquor. In some works it is the practice to feed cold water into the hydraulic main on the slightest pretext, thereby making an ammonia washer of the hydraulic main and spoiling the liquor; while in other works the hydraulic main performs its function continuously, without any doctoring. The trouble is partly in the management and partly in the method of relieving the main of tar; but the requirements of good main construction are now so well known that it is unnecessary to further dwell on this matter.

By omitting the lime apparatus, the price of the still is greatly reduced, and the attendance confined to the running of the liquor pump and the starting and stopping of the still, provided the steam supply is controlled by a thermostat in the vapour pipe and the apparatus is so constructed that a commercial concentrate can be made without troubles from stoppages and consequent loss of ammonia. The illustration shows such an apparatus. It will be noticed that the weak liquor is preheated in the seal-pot by the heat of the waste liquor; the exhaust steam from the liquor pump is utilized in the still; and the live steam goes to the still controlled by a thermostatic regulator.



Ammonia Liquor Plant.

The still illustrated will make a 20 per cent. concentrate without troubles from salting, by an arrangement on top, called a heater, in which the weak liquor is further heated to about 190° before entering the still proper; and the gases liberated in the heater are washed by the cool liquor passing downward through the washer, so that the ammonia is absorbed, but the gases expelled into the atmosphere. This is very important when lime is not used; otherwise it may become impossible to make a concentrate with more than 13 per cent. of ammonia, without stoppages in the condenser and salt in the storage tank. The concentrate, when made as explained, becomes more valuable to the refiner, because less impurities will have to be removed; and the stronger the concentrate, the less it will cost to transport per pound of ammonia.

It will be noticed that the washer also serves as a second absorber. The heating of the weak liquor in the heater is accomplished by the vapours passing through lead coils on their way to the condenser, and the condensate produced thereby is returned to the still. The condensing of the vapours takes place in a lead coil, surrounded by cooling water in the condenser, and in the absorber in which the concentrate is cooled by water passing through a lead coil on its way to the condenser.

All the parts coming in contact with ammonia vapours are made of cast iron and lead. All pipes liable to stoppages have connections for blowing-out with steam; but this is necessary only when starting the still, and is done in a few minutes. Each of the sections shown, with the exception of the section underneath the heater, has two compartments, so there are thirteen compartments in the still and two in the washer. Each compartment is provided with a large cleaning opening, covered with a faced cast-iron plate. The still shown is 24 inches in diameter and has a capacity of about 150 gallons of weak liquor per hour.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Alliance and Dublin Gas Company's Affairs.

SIR,—That the Manchester Directors of the Dublin Company are perpetuating the old Board's policy of reticence need not, by now, cause any surprise. Those who have followed my criticisms will appreciate the point. The experts' report was impounded, followed by a rapid candidature of the three new Directors, which was quite contrary to the line of thought first created when Mr. Dickens made his *début* to the shareholders. However, there it is! The glory goes to the bold warrior; so, at the last half-yearly meeting did our Manchester men accept honours—especially so of a comforting nature.

I thought at least that, with all these manifold blessings being showered on the three pioneers, some little comfort would have been thrown out to those who have laboured equally—at least, in their earnestness—towards the redemption of this unfortunate Company. But, no, the whirl of the meeting and the excitement of so brilliant a balance-sheet prevented any explanation of those pointed comments which I made on the preceding report and accounts—those to the 31st of December last. At any rate, even supposing I do not get any reply from the new constitution, it only parallels with the attitude of the old Board, who wisely (?) held their peace. But the day came! Now I do not propose to let the affairs of the Dublin Company pass without future criticism, even though the Board are reconstructed and backed-up by eminent experts to keep them right.

Let us take the last accounts. The working profit shown amounted to £59,340. Excellent! But let us examine closely. The comparison so naïvely made by the Chairman with the corresponding period of 1914 can be brushed aside—that was a sweeping-up period, a time of reconstruction, and as such the drop in profits had its own significance. No! Let us go back to 1912—a half year prejudiced by the great coal strike. Repeating the Chairman's words—"owing to the different form on which the statement of accounts was presented, comparison with corresponding periods was impossible." This may be so, and we can conclude that the expenses [1915] charged to revenue were strictly legitimate, and no depreciation or special expenditure in any form or shape was included. What, then, did we get in 1912? A revealed profit of £47,350. Yes; but you say, that is £12,000 less than the last June accounts. Granted; but, in the first place, the price of gas was 2d. per 1000 cubic feet less in 1912 (Dublin gas is now at a minimum of 3s. 6d. per 1000 cubic feet); and this 2d. increase represents nearly £6000 for the half year. Then as to the balance, I suggest that the £12,203 charged to profit and loss should be put against revenue, in which case the gilt is at once taken off the gingerbread, or, in other words, the brilliant half-year's accounts for June, 1915, sink below the standard of the old *régime* during a very trying half year. Where was the great glory justifying such liberal recognition of the services rendered by the special Directors? I cannot see the justification; but, in any case, I throw out a challenge to the Board. I question whether I shall get an explanation; but there is no doubt, as time goes on, I will trace the comparisons. So much for finance.

Now for a few brief words otherwise. The Chairman attached great importance to the coal question, and to the valuable assistance rendered in this respect by the new Directors. Well, I have examined this point so far as reports are concerned, and find in June, 1912, the net cost of gas (coal and oil) was about 8¼d., and for June, 1915, about ¼d. more per 1000 cubic feet sold. Nothing to boast about!

Then the total sales of gas show a decrease of nearly ¾ per cent., against a decrease of nearly ⅞ per cent. over the corresponding period. Not progressing in the sale of gas; and both half years in question under the control of the Manchester men.

Another point. The gas unaccounted for represents 12·8 per cent., against the June half of 1914 12·9 per cent.—again under the auspices of the new blood. The June half year of 1913 showed the unaccounted-for gas as 10·1 per cent.; and this was too high. Things are getting worse under this head.

I am still wondering where the blessings are coming from, and who is the Napoleon?

R. W. EDWARDS ["NONULUS"].

Oct. 14, 1915.

P.S.—The item, £8119 17s., for special purposes is a legitimate debit against the half-year's revenue, as is clearly emphasized by the model clause—"The directors of the company may, if they think fit in any half year, appropriate out of the revenue of the company *as part of the expenditure on revenue account . . .*;" and this is borne out by such charge being, when spent, an allowance by the income tax authorities. Why then put it against the profit and loss account?—R. W. E.

Control of Gas Passing through Purifiers.

SIR,—With reference to patent No. 844, dated Jan. 19, 1915, granted to G. F. H. Beard, J. W. Scott, and R. & J. Dempster, Limited, and described in the "JOURNAL" for Aug. 24, I should like to point out that the proposed method of control of gas passing through the purifiers is by no means a new idea; it being the common practice carried out by engineers in this country [U.S.A.] for over twenty years.

By means of the Creighton valve, as extensively used in America, the method of control is much simplified, as only one control valve is required to each box, in place of two by the patentees' method. One connection from the Creighton valve passes direct to the centre or between the two layers of oxide in the box; the other connection communicates direct with the control valve. Assuming the gas passes between the layers, and upwards through the top layer and downwards through the bottom layer, it passes away through the top and bottom of the lute—both lute-valves being open.

Reverse flow is obtained by reversing the inlet and outlet of the connections to the purifier at the Creighton valve, which does not in any way interfere with the course of the gas in the other three boxes of the set, and can be completed in a few seconds. In case of excessive fouling of either layer, the top or bottom of the lute may be closed (or partially closed) and the gas made to pass upwards or downwards, or an excessive quantity of gas made to pass through one layer in case that layer is less fouled than the other.

In American practice, layers of oxide about 5 to 6 feet deep are used. By the above method much mechanical complication is done away with, and quicker control of the gas is obtained.

CHICAGO.

Sept. 26, 1915.

Incandescent Lighting and Calorific Value.

SIR,—I have read with interest the comments in your issue of July 27, on the "Composition of Gas in Relation to the Performance of the Bunsen Burner." I am inclined to think that your main objections result from the divergent connotations of the word "standard." As used in this country in connection with gas supply, it has come to imply a sort of secondary unit, of such a character that its numerical value is directly proportional to the usefulness of the product to which the standard is applied. For example, the candle-power standard, as applied to gas used in open-flame burners, expresses numerically and exactly the value of the gas for this purpose. One cubic foot of 20-candle power gas is worth precisely twice as much as one cubic foot of 10-candle power gas. It was my purpose to show that this relation does not hold with regard to the calorific value of gas used in the incandescent burner, but that the light output per cubic foot decreases with increased calorific value at the same rate as the calorific value increases.

You state that the general relation of decreasing light output per B.Th.U. to increasing calorific value is "now an accepted fact." This is evidently true of England; but it is not true of the United States. On the contrary, I appear to be quite alone in my adherence to this idea. In presenting the results of my experiments, I sought to establish the quantitative relations existing between these quantities. You grant that the statement is qualitatively true, but attempt to dispose of the quantitative relations by the mere statement, "It is not so." Now, when one tests a gas of 480 B.Th.U., and finds that 4·6 cubic feet give 116-candle power in an incandescent burner, and then tests a gas of 660 B.Th.U., and finds that 4·6 cubic feet give 116-candle power in the same burner, and numerous repetitions of the tests with substantially similar gases show similar results, I should like to know what you would consider a reasonable conclusion. My tests covered eighty different gases ranging from 480 to 660 B.Th.U. per cubic foot. The mantle candle-power was substantially constant, likewise the gas consumption—referring to averages of each range of calorific value of (say) 20 B.Th.U.

If these data are accurate, it is proved—at least, for this particular lamp—that light output per cubic foot is practically independent of calorific value; and if this be the case, how can calorific value be any more valuable than candle power as a term in which to express numerically the value of a gas for incandescent gas lighting?

Any challenging of this position must be based upon an equally exhaustive series of tests from which contrary conclusions may be drawn. Likewise, if one wishes to challenge the statement that flame-temperature affects efficiency in a majority of practical applications of gas, experimental evidence of a broad and comprehensive character should be submitted.

As to the desirability of prescribing certain ranges of specific gravity and calorific value for the regulation of gas supply, that is as obvious as the desirability of prescribing pressure ranges, and for the very same reasons.

It is quite apparent that no single property, or group of properties, of gas can be made to serve as a standard in which the usefulness of the gas may be numerically expressed, because no property bears any fundamental relation to all the others.

There is surely no objection to centring the requirement for gas supply around a specification of calorific value ranges, provided it is understood that this cannot be regarded as a standard in the same sense as gas candle power, and that under some circumstances the value of gas service to the consumer might be actually increased by decreasing the calorific value, even without a corresponding reduction in the price of the gas per cubic foot. This is now true as to incandescent lighting.

As regards the effect of flame temperature upon processes other than incandescent lighting, it is only necessary, in order to establish a reasonable presumption, to call attention to the supersession of the yellow-flame burner by the bunsen burner. For all processes in which flame temperature does not affect efficiency, there is surely little excuse for the bunsen burner. It is quite practicable to design nearly all appliances for yellow-flame burners so as to provide against the deposit of soot, and ensure the rejection of products of combustion at the same temperature obtained with the bunsen burner; and the yellow-flame burner is vastly cheaper and more convenient.

What percentage of the gas sold in England (except for open-flame lighting) is used in yellow-flame burners? Is not the preference for the bunsen burner in any application presumptive evidence that flame temperature, or its concomitants, plays an important part in the efficiency of utilization?

R. FFRENCH PIERCE,
Welsbach Company's Illuminating Engineering Laboratories.

Gloucester, N.J., U.S.A.,
Oct. 1, 1915.

[We are pleased to receive the foregoing letter from Mr. ffrench Pierce; but we wish it had been characterized by rather more lucidity, as it is very difficult to carry on a discussion without one knows precisely what is intended. In the first place, there must be dissent from the statement that we said in an article on July 27 (p. 175) anything quite so crude as that "the genera relation of decreasing light output per B.Th.U. to increasing calorific value is now an accepted fact." What was actually said may be gathered by reference to the article. From much of what follows in our correspondent's letter, it seems to us his failure to make correct deductions from the photometrical

results that he obtained, using incandescent burners with gas of varying calorific value, is due to a want of appreciation of, or acquaintance with, certain well-established principles associated with gas combustion. Take this statement: "When one tests a gas of 480 B.Th.U., and finds that 4·6 cubic feet of it give 116-candle power in an incandescent burner, and then tests a gas of 660 B.Th.U., and finds that 4·6 cubic feet give 116-candle power in the same burner, . . . I should like to be informed as to what you consider a reasonable conclusion." In the first place, we cannot bestow the slightest comparative value upon tests carried out in the way described. A burner which, consuming 4·6 cubic feet of 480 B.Th.U. gas per hour, gives 116-candle power, ought not to be used at a fixed rate of gas consumption for all gases. The very fact that a gas of 660 B.Th.U. was used in the same burner at the same rate of consumption as the gas of 480 B.Th.U. (we take it, too, the same size mantle was employed) was not doing justice to the higher calorific gas. And though we are not advocates of a gas of such high calorific power for general purposes, we are for having the gas treated in a way that will allow it to give the best possible account of itself. One reason then why one or the other of the gases was not giving a proper result was that it was being imperfectly used. Another reason why the high calorific value gas was not doing better in total candle power than the other was that for complete combustion a larger quantity of air was required; and the larger the quantity of the inert constituents nitrogen and carbonic acid introduced to the gas and the flame, the greater the cooling effect upon the flame, and the greater the amount of heat taking flight with the products of combustion. For incandescent lighting, it is very important that anything which has a cooling effect on flame should be reduced to as low a point as possible, consistent with realizing complete combustion. As we do not, and cannot, admit the sufficient accuracy for fundamental purposes of the data supplied by our correspondent, we cannot agree that it is proved "that light output per cubic foot is practically independent of calorific value." Following which, our correspondent asks: "If this be the case, how can calorific value be any more valuable than candle-power as a term in which to express numerically the value of a gas for incandescent lighting." Flame temperature is a result of, among other factors, calorific power; it is not a result of candle power. We assume that Mr. Pierce means by "candle-power" the light obtained from a naked flame; he surely cannot mean candle-power as developed by an incandescent burner, as that would vary with the same gas according to burner, pressure, &c. It was shown recently in the "JOURNAL" that, by removing from a gas the greater proportion of its benzol a 16·11-candle gas was reduced to 10·51-candle power—a reduction of 34·7 per cent. of luminous value. The calorific value of the 16·11-candle gas was 585·3 B.Th.U. gross; of the 10·51-candle gas, 559·1 B.Th.U.—a reduction of only 4·5 per cent. Perhaps this illustration will be sufficient to show Mr. Pierce how calorific value can really be "more valuable than candle-power as a term in which to express numerically the value of a gas for incandescent lighting." Then our correspondent remarks that "if one wishes to challenge the statement that flame temperature affects efficiency in a majority of practical applications of gas, experimental evidence of a broad and comprehensive character should be submitted." The conditions that produce a high-flame temperature, with a given consumption of gas, may not be the best for all purposes. In incandescent lighting, the less cooling nitrogen and carbonic acid that are introduced into a flame through the air supply, the better; and the greater the proportion of hydrogen in the mixture, the smaller the volume of the flame, and the higher the temperature of the flame. And the photometric intensity of the light from a mantle increases very rapidly with the temperature of the flame—the mantle being thin it rapidly emits the light radiations due to its incandescing. But the conditions are different in a gas-fire. A long flame, and a flame of larger volume, is required, for the larger area of heat-radiating surface. Practicability has to be taken into the reckoning. Under the circumstances of the gas-fire, we do not need the condensed high-temperature flame that is the best for service in the incandescent burner. Take, again, the water-flow calorimeter. There the high-temperature flame has no particular virtue; all that is required is that the heat energy of the gas is allowed to give full account of itself. The same with water heating by gas. The same, too, in furnace heating, in which volume of flame is required to do the work. These are matters upon which to-day there is no necessity for "experimental evidence of a broad and comprehensive character." They are generally quite well appreciated. Regarding the point that "for all processes in which flame temperature does not affect efficiency, there is surely little excuse for the bunsen burner," also what is said as to yellow flames, and the final question, "Is not the preference for the bunsen burner in any application presumptive evidence that flame temperature, or its concomitants [what is meant by this we do not exactly know], plays an important part in the efficiency of utilization?"—all that it is necessary to say is that the use of the bunsen burner is largely a matter of convenience and working efficiency. Perhaps Mr. Pierce does not know that, in the standard calorimeter in this country, flat-flame burners are employed—apparently for the reasons that a high combustion chamber is unnecessary, and that the luminous flames have the effect of distributing the heat. In view of this, if Mr. Pierce were right in his contentions, then Professor Boys, the Metropolitan Gas Referees, and all who have endorsed the use of flat-flame burners for assigning to gas, under the conditions of the calorimeter, its total thermal value ought to be downright ashamed of themselves.—ED., J.G.L.]

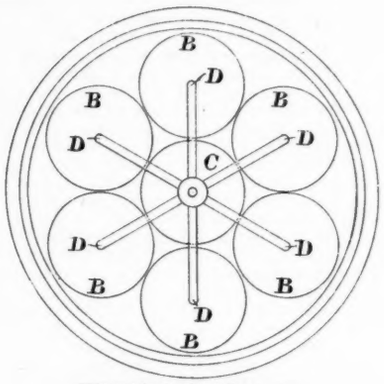
REGISTER OF PATENTS.

Gas-Governors.

M'LACHLAN, R. W., of Enfield Highway, N.

No. 21,626; Oct. 28, 1914.

This invention refers to constant pressure gas-governors in which valve controlling devices on the metallic bellows principle are used. A type of such devices will be seen in patents No. 463 of 1906 and No. 24,466 of 1913. The object of the invention is to obtain a greater capacity of gas by the use of larger valves than those which can be controlled by the use of a single metallic bellows controlling device which, "owing to the weight of metal required to construct these bellows, it has been found that a single bellows cannot be conveniently made to lift and control valves sufficiently large in diameter to give the desired capacity of gas required in constant-pressure service governors."



M'Lachlan's Gas-Governor.

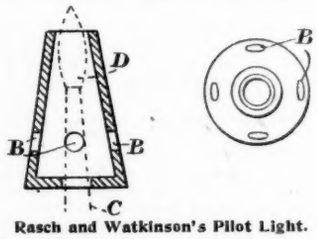
The improvement is as follows: A number of metallic bellows made of light material and of suitable size are fixed together, and applied to a valve of suitable diameter, as shown in the engraving—a top view of a governor casing with its cover removed and showing a number of bellows mounted on a base-plate and connected together, and applied to a valve rod. The bellows are connected to centre bellows C by the plates or strips D, thereby causing all of them to work uniformly together, "and having seven times the amount of controlling power over the valve than the single bellows."

Pilot Lights for Gas-Burners.

RASCH, L., of South Norwood, and WATKINSON, F., of Farringdon Road, E.C.

No. 4280; March 18, 1915.

This invention relates to pilot lights—comprising a jet surrounded by a truncated coned shield so disposed that the flame passes through



Rasch and Watkinson's Pilot Light.

the orifice at the apex; the cone being closed at the base and provided with holes near the base.

A cross section and a plan are given of one form of shield—made in accordance with the invention. It is a hollow truncated cone of

metal closed at the base, with holes B near the base to supply air to the small flame or jet. The pipe C, carrying the gas to the jet D, passes through the centre of the base. Thus when the pilot light is burning the shield becomes hot and the air which supports combustion is warmed in passing through the holes near the base of the shield and by the surrounding metal. The air directed on to the flame is thus heated and produces a longer and hotter flame; so that, it is said, "the pilot light will not be extinguished even in a violent draught of air, or by explosion or suction."

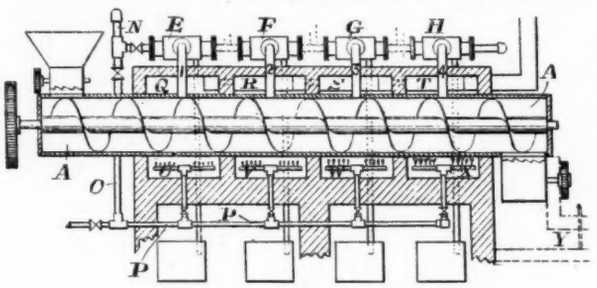
Distilling Volatile Products from Carbonaceous Material.

PRIOLEAU, J. R. H. & W. L. ST. J., of Trafalgar Square, Chelsea.

No. 9375; June 26, 1915.

This invention relates to apparatus for the destructive distillation of carbonaceous materials, of the type in which different volatile products are withdrawn from different parts of the retort; and its object is "to provide means for accurately varying the temperature over a series of different zones in the retort according to the distillates required from the particular zones."

The inventors propose to employ a single-chamber surface-heated retort (whether vertical or horizontal) and in connection with it to divide-up a flue space or jacket surrounding the retort by means of transverse partitions, which definitely separate the length of the retort externally into a series of zones. In each zone a separate furnace or burner with independent control for the supply of a heating medium thereto is provided; so that the successive zones may proceed either with a gentle and successive temperature increase, or by temperature differences of considerable amount, or, again, by an increase and then a decrease as desired. Connected with each zone is a condenser, whereby volatile products due to the temperature at which the particular zone is kept are quickly, directly, and simultaneously withdrawn.



Prioleau's Coal Distillation Apparatus.

A particular method to which the invention is especially applicable is set forth in patent No. 23,165 of 1914 [see "JOURNAL" for Sept. 28, p. 711], in which the condensers are operated by a cool non-condensable gas; and the accompanying illustration shows its adaptation thereto.

A single chamber retort A is carried in a furnace setting having the partition walls definitely dividing-up the surface-heating flues into zones Q, R, S, T; and separate burners U, V, W, X, are arranged in the respective flues, each controlled by a valve. The conveyor screw shown is for slowly traversing the material through the retort.

The several supply pipes are connected to a main supply pipe P, which may, in turn, be supplied either from the gas supply O, coming from the retort through the condensers by a pipe which connects to the pipe N, near which the valves are arranged which distribute the non-condensable gases to the condensers and the gas supply pipe O. Necessary washing, cooling, or other apparatus is arranged between the two pipes.

In the concurrent application volatile matters are directly and simultaneously removed from the retort by pipes 1, 2, 3, 4—such volatile matters varying according to the temperature of the several zones; and they are immediately condensed in a series of ejector condensers E, F, G, H, by cool gases supplied from the pipe N, and the distillates removed through pipes provided for the purpose.

There are openings from each zone into a common flue to the chimney arranged in the side wall of the retort; but by the use of dampers and auxiliary flues, or by connecting passages (shown dotted) through the walls, the hot gases may be carried from one zone to another—dampers being provided to vary the path of the combustion gases as desired. Air for combustion is admitted by openings beneath the burners, or by dampered openings in the base of the side walls.

The final product from the conveyor will be coke; and in order to get this of a harder character, a chamber shown dotted at Y may be employed in which the coke coming out of the delivery shoot is heated up to about 800° C. It is provided with additional heating apparatus (not shown) for the purpose.

Gas Cooking Apparatus.

NOONAN, J. H., of Auckland, New Zealand.

No. 11,269; Aug. 4, 1915. Convention date, Aug. 5, 1914.

This gas cooking apparatus is intended to provide means whereby any number of utensils containing food may be heated or kept heated at the same time.

The apparatus comprises a central gas distributing chamber connected with a gas service; heating burners, with supporting legs and upper projections, arranged around and connected to the chamber; gas-cocks controlling the gas supply to each burner from the central chamber; and an illuminating burner fitted with a gas-cock, and connected to the central chamber. Stand burners are arranged round, and connected to, a central gas distributing chamber—each burner being supplied with gas from the chamber through an independent gas-cock fitted in the wall of the chamber.

LEGAL INTELLIGENCE.

DUNDALK VALUATION APPEALS.

At the Dundalk Quarter Sessions last Wednesday week, before his Honour Judge GREEN, K.C., the Dundalk Gas Company appealed against a valuation by the Commissioners of Valuation of £800 on their premises; and the Dundalk Urban Council appealed against the valuation on the ground that it was insufficient. The Council also appealed against the valuation made by the Commissioners on their electricity undertaking.

Mr. HENRY HANNA, K.C., appeared for the Gas Company; Mr. J. C. LARDNER, B.L., for the Urban Council; and Mr. GARTLAN, for the Commissioners of Valuation.

Mr. HANNA, in opening the Gas Company's appeal, said the amount of the valuation that had been fixed by the Commissioners on their undertaking was £800, of which £500 was for the house and works, and £300 for the mains and easements over the streets. The undertaking was carried on under an Act passed in 1887. It was necessary to point out to the Court, in considering the question, the falling off in receipts of the Company in recent years. The Council in 1912 started an electrical undertaking; and the evidence would show that the year before this undertaking was commenced the Gas Company's profits were £2748. The result of the electrical undertaking had been that in 1914 his clients' profits were only £1731; so that in three years they had fallen by £1000. This was due to the success of the electrical concern, which was able to take from the Company some of their very best customers; and they were tied by the agreement not to take any other form of light. Not only were their profits reduced, but they had still the same expenditure in many ways. Except a possible reduction of coal, there would be very little change in the expenses of carrying on the works. Up to 1914, the undertaking was valued at £1070. When the Company served notice, the Commissioners of Valuation had the works revalued, and reduced the figure to £950. They did not appeal to Quarter Sessions on that occasion; but when they came to this year, the Directors, being faced with the position that they were paying rates upon a very large amount, and the electrical undertaking on a very small amount, served notice on the Commissioners for a further reduction, who reduced the amount to £800. The valuation of the electrical undertaking was only £440. Of course, the electrical undertaking was the property of the Municipality; but this was no reason why it should be valued at such a low figure. He was not concerned as to whether or not the electrical undertaking was carried on at a profit. The Gas Company contended that, so far as their business was concerned, the valuation of £800 should be reduced. Explaining the system on which these valuations were arrived at, Counsel said that, after making the usual deductions, there would be a balance of £536, which the Company maintained was the net profit on the undertaking. A rate of 6s. in the pound on this would be £160. The business of the Company had gone down one-half in three years, while their valuation had only gone down one-fifth.

Mr. *William Cheeke*, M.Inst.C.E., gave figures on which he said the rateable value of the undertaking would be £370.

Mr. *George Airth*, the Manager of the Company, said the reduction of profits between 1911 and 1914 was 37 per cent.; the output declining from 54½ to 44½ million cubic feet. They had lost the contract for street lighting; and the lamp standards were useless. They had been refused permission to put gas in the municipal houses. Between 1911 and 1914, the reduction of receipts from the Great Northern Railway Company was £150; and they had made a contract with the Urban Council to take a certain amount of electricity from them which would further reduce their consumption of gas. The Steam Packet Company had electricity at 4d. per unit, on condition they burned no gas.

Mr. LARDNER said there was no such condition.

Witness (continuing) said that in Dundalk the gas undertaking paid 12·84 per cent. in rates, in Drogheda 4 per cent., and in Armagh 8 per cent., on the cost per 1000 cubic feet of gas.

By Mr. LARDNER: In 1905, when there was no electric light, the make of gas was 42 million cubic feet. The price of gas was then 3s. 11½d. per 1000 cubic feet; and it was now 3s. 9d. At present there were 558 cookers in use in Dundalk; and in 1905 there were 58. For renewal of works they paid 6d. per 1000 cubic feet. All told, they had about 25 gas-fires in Dundalk.

Mr. *Isdell*, for the Council, said the average net receipts of the Company for three years were £2603. He submitted calculations, the valuation on the basis of which was £993. He thought there was a great future before the Company.

Mr. *Carberry*, Reviser for the district, deposed that the first assessment on the Gas Company was £1020, and last year the figure was reduced to £848. He did not make the valuation himself. The Commissioner of Valuation sent him the papers, and asked him to explain the figures. They were based on 1912-13-14.

Mr. HANNA objected to Mr. Carberry giving evidence, as he had not valued the works himself.

Mr. LARDNER, addressing the Court, said the Company were going through what other companies in similar circumstances had had to go through; and when this was over, they would come into their own. The Council would be glad to see them prosper. A new field of work was opened up to them in gas heating and cooking. The figure of £370 for the valuation put forward by Mr. Cheeke was altogether disproportionate. Though they might be staggered for a year or two by the electrical undertaking, they had now come back to their own. Another thing the Court would have to take into consideration was the fact that the electrical undertaking had reached its maximum; and the cloud on the Gas Company had passed away. He held that the old valuation of the Commissioners should be reinstated.

Mr. HANNA said there were two facts that could not be explained away—the decrease in the profits of the Company, and the falling-off in the output of gas. The valuation had only been reduced from £1000

to £800, while the profits had decreased by 33 per cent. The valuation of £800 should be substantially reduced.

His HONOUR reserved his decision in this case until after hearing the Council's appeal as to the valuation of the electricity undertaking.

Mr. LARDNER pointed out that the electric lighting undertaking was started by the Council in the year 1912. It was a small thing in the beginning; and the valuation fixed by the Commissioners was £50 the first year, with no sum assessed on the rates for overhead and underground cables. The valuation was now increased to £440—being £140 on buildings, and £300 on right-of-way for cables. The Council appealed to the Commissioners on the ground that it was too high. At the same time, the Gas Company appealed on the ground that it was too low. The result of the appeal was that the Commissioners left the figures as they were originally fixed. In this case, they took the highest year of three for the purpose of valuation.

Mr. *P. A. Spalding* deposed that the total expenditure on the undertaking was £33,265; and when he made deductions for tenants' fittings, the net amount was £22,231.

By Mr. HANNA: He was aware that the Gas Company's paid-up capital was £22,000.

Mr. *Isdell* arrived at a valuation for the whole concern of £255.

Mr. HANNA then submitted that the valuation should be increased somewhat.

Mr. *Cheeke* presented a valuation of £487.

His HONOUR announced that the Magistrates fixed the valuation of the Gas Company's undertaking at £734, and of the electric lighting concern at £418. They considered in the former case that the average for two years was the fairest method of arriving at a valuation.

Mr. LARDNER asked if the Court had taken into consideration a deduction to make relative.

His HONOUR said they had made a deduction of 15 per cent. to make relative.

Mr. LARDNER said he thought they were not entitled to do so; and he quoted a case in which it was held that it was not legal to make such a deduction.

His HONOUR: It is a matter of common practice that it should be done.

Mr. LARDNER: I am raising the point on specific instructions.

His HONOUR: It has never been raised before here; and it is extremely awkward to have it raised now.

His HONOUR (after another retirement) said the Court considered the valuation made by the Commissioner in both cases was fair.

Mr. HANNA applied for a case to be stated, on the ground that the decision of the Court had been given before the point was raised, and that Counsel was not entitled to know whether relative value had been taken into account.

His HONOUR thought he could not state a case excepting on the question as to whether they were entitled to make a "relative deduction." He could not see on what principle of equity or justice this question had been raised by the Council, having regard to the practice adopted in the Court openly for years. He could not see what principle of justice would be served by abandoning this principle; and he could not say what reasons the Council had for raising it.

Mr. HANNA: They had a reason—that the party against whom it is to be enforced is the Gas Company.

Mr. LARDNER said that, having regard to his Honour's remarks, he was instructed by the Chairman of the Council to say they would leave the cases in his Honour's hands to deal with them as he wished.

His HONOUR: I am much obliged to the Council. The valuations in these cases will remain at the figure settled by the Commissioner of Valuation.

Economy at Middlesbrough.—It is reported that a specially appointed Committee on Economies have recommended to the General Purposes Committee of the Middlesbrough Corporation that, among other official changes, the appointments of Mr. David Terrace (the Gas Manager) and of Mr. G. F. Blincoe (Assistant-Manager) be terminated, with a view to a Manager being appointed to take sole control of the undertaking. Numerous reductions of salary were suggested.

Lighting Matters at Wantage.—At the Wantage Urban District Council meeting last week, the Gas Committee submitted the annual balance-sheet, and, in view of the favourable results, recommended that the price of gas be raised to 4s. per 1000 cubic feet only, instead of 4s. 2d., as previously decided, and that £50 be allocated to the relief of the rates. Mr. A. J. Belcher (the Chairman of the Committee), in moving the adoption of the report, mentioned a few figures by way of comparison. He said that more than £100 extra had been paid for coal; but the income from private consumers was up £178. They had made a gross profit on the year of £452, in spite of the fact that the price of gas was reduced 5d. per 1000 cubic feet. With regard to the proposal to allocate £50 to the relief of the rates, the Chairman said they did not consider it advisable to deplete the balance further, in view of the fact that before long it would be absolutely necessary to provide a new holder, which would cost at least £1000. The report was adopted.

Swansea's Restricted Lighting.—The Swansea Highways Committee have, on the suggestion of the Borough Surveyor, agreed to the following arrangements in connection with the public lighting. Generally speaking, every alternate lamp not to be lighted; this not to apply to electric lamps, as these are in series of nine, and one could not be extinguished without affecting the nine. Public lamps at street corners to be kept lighted. The whole of the remaining lamps to be turned off at midnight. Lamps at refuges or islands situated in the carriage-way at the junction of two or more roads to be kept lighted all night. Arrangements as to the reduction in price are to be made with the Electricity Department; but with regard to the Gas Company, they have agreed that the total quantity of unconsumed gas be not charged for. The Company at their own expense are to take down the lanterns, burners, &c., and carefully store them until the Corporation require them to be refixed. Inasmuch as the lighters and extinguishers of the Company will be required to go practically the same rounds, the Corporation are to bear half the estimated loss of 18s. per lamp. The estimated net saving to the Corporation over the twelve months is £4000.

MISCELLANEOUS NEWS.

LEEDS UNIVERSITY DEPARTMENT OF COAL GAS AND FUEL INDUSTRIES.

The Report of the Livesey Professor.

There has just been issued the report that Professor John W. Cobb, B.Sc., F.I.C., made to the Chairman (Alderman C. F. Tetley, M.A.) and the members of the Livesey Advisory Committee on the work of the Leeds University Department of Coal Gas and Fuel Industries for the session 1914-15.

Professor Cobb begins by pointing out that the influence of the war was indicated at the opening of the session by a complete reversal of the progress in numbers which he had been able to report in the two previous sessions. Of last year's students who would normally have been at work this year four now hold Commissions; and the Department is also represented in the Royal Army Medical Corps, the Public Schools Battalion, and other branches of the Service. Two students who were to have continued research left to meet the demand for special help in the gas industry. One student who had entered the gas industry returned to the Officers' Training Corps, and has now obtained a Commission. Of the two senior students who remained, one to take a diploma and the other an honours degree, the one is awaiting a Commission and the other has volunteered for special chemical service. The temporary depletion of the department of its students has therefore gone very far; but the demand which seems certain to become insistent in the near future, for scientifically trained men in all industries, can be relied on to correct this shortcoming.

SPECIAL LECTURES.

These were arranged for Tuesday and Wednesday evenings in the second term. The eight Tuesday lectures were in Bye-Product Coke-Oven Practice, and were given by Mr. Greaves, F.I.C., of the Otto Coke-Oven Company. A large entry was not expected; but it was thought advisable to offer the opportunity of attendance in view of the increasing importance of the industry, and having regard to the probability that the technical control of these plants would, during and after the war, be more exclusively in the hands of our own people. Nine students attended; and, on the conclusion of the course, three Saturday visits were made to typical coke-oven plants on which the coking process, the recovery of ammonia, benzol, toluol, and other tar products, as effected by different methods, could be seen and compared—viz., the Nunnery Colliery Company, the Middleton Colliery Company, and the Ackton Hall Colliery Company, who were duly thanked for their kindness in this connection, and also the officials of the firms who gave so freely their time and attention to the work of demonstration and explanation. The entries did not warrant proceeding with the lectures on the distribution and uses of coal gas, and on gas-producer practice, arranged for Wednesday evenings.

EVENING LABORATORY WORK.

During the second term the laboratories were opened on Wednesday evenings for a limited number of students; and this year three students of gas engineering and three of metallurgy attended for instruction in practical laboratory work. Three of these had attended in the previous session. The primary purpose of the laboratory course is to supplement by more advanced work the training of students who have already gone as far as the equipment of the technical schools allows. It is also designed to use the laboratory and its equipment for the advantage of men whose general scientific training had been completed, but who on entering industries find the advisability of acquiring more special knowledge concerning the control of fuel supplies and fuel-using appliances, and the use of pyrometers and modern methods of metallography.

RESEARCH.

The Joint Committee of the Institution of Gas Engineers and the University of Leeds has continued work and presented its second report in regard to ventilation. The draught-proof building specially erected for the work has shown under repeated tests that it serves its purpose, and experiments have been made with results of a much more definite and reliable character than could have been obtained without it. Most immediately applicable to practice is probably the demonstration that even the most modern types of gas-fires differ so much among themselves in the degree to which they effect the ventilation of a room when burning under the same conditions. The usefulness of the work of this course would not, Professor Cobb thinks, be questioned. He thanks Mr. W. Harrison, M.Sc., the Research Chemist, for the zeal and ability he has displayed in carrying it out.

A paper, entitled "Thermal Conductivity of Refractory Materials," by Messrs. G. Dougill, M.Sc., H. J. Hodsman, M.Sc., and J. W. Cobb, B.Sc., embodying the results of research which had occupied the department for two years, was read by Professor Cobb before the Society of Chemical Industry, Yorkshire Section, and appeared in the "Journal of the Society of Chemical Industry," for May 15 last.* It deals with a new method which can be employed for determining the thermal conductivity of refractory materials in the forms in which they come into use in furnace construction, as bricks or blocks. Fire-clay and siliceous bricks and silica and magnesia bricks were examined at different temperatures. This work has been continued during the session with the assistance of Mr. H. M. Wolfe, who has studied the conductivity of bricks of bauxite, carborundum, and chromite. Fire-clay bricks specially made by the Farnley Iron Company, of different degrees of porosity, have also been tested to enable the influence of this factor to be more specially determined, and the alteration of the influence with temperature.

A paper presenting the more purely scientific aspect of the department's work, on the thermal phenomena of carbonization and the "Correlation of Thermal and Chemical Phenomena," was read before

* See "JOURNAL," May 25, p. 454.

the Chemical Society on June 3. The authors had examined cellulose, dehydrated cellulose, and lignite, intermediate stages in the conversion of wood into coal, and also pyridine and pyridine-chloroform extracts of coal supplied to them by Dr. Wheeler, of the Eskmeals Laboratory. The paper, entitled "A Thermal Study of the Carbonization Process," was by Messrs. Harold Hollings, M.Sc., and J. W. Cobb, B.Sc.; and it appeared in the "Transactions" of the Chemical Society for 1915, Vol. CVII., p. 1106 [*ante*, p. 24].

Mr. Hodsman, Assistant Lecturer and Demonstrator, and Professor Cobb have carried out the preliminaries of a research on toluol which, he considers, may be of some service.

Gas Research Fellowship.

Mr. Hollings resigned the Gas Research Fellowship on his election to the 1851 Exhibition Scholarship. He has been allowed to suspend that scholarship and to enter the laboratories of the South Metropolitan Gas Company, where he has been engaged at first in research and later on special war work. With the approval of the President of the Institution and theChairman of the Livesey Advisory Committee, it was decided not to advertise the vacant Gas Research Fellowship, and the position has not been filled, although it is proposed to proceed to the election of a fellow at any time when circumstances suggest the desirability of taking this course.

Refractory Materials.

At the invitation of the Council of the Institution of Gas Engineers, Professor Cobb joined its "Committee on Refractory Materials," and numerous tests of such materials have been made during the session in the laboratory.

Corbet Woodall Scholarship.

By the generosity of Sir Corbet Woodall, the report points out, a fund was placed at the disposal of the Institution of Gas Engineers for the endowment of a scholarship in gas engineering; and the Special Committee appointed by the Institution to deal with the matter decided that the scholarship should be made tenable at the University of Leeds. The Senate and Council of the University in turn welcomed the proposed new scholarship, and details as to the mode of selection and the course of training have been settled and are set out in the "University Calendar" (1915-16). There will, however, be no election this year.

Museum.

The most noticeable additions to the museum made this year are models of vertical and inclined retort plants, loaned by the Vertical Retort Syndicate, and Goodall, Clayton, and Co. Such models of plant are not only interesting as exhibits, Professor Cobb mentions, but extremely useful in lectures; and it is hoped that a considerable collection of them may gradually be made.

A number of prominent firms in the gas, coke-oven, and allied industries had offered facilities for placing students in works during the long vacation, but it was only possible to take advantage of their kindness to a limited extent.

Finally Professor Cobb records his appreciation of the value of the services rendered to the department by Mr. H. J. Hodsman, M.Sc., his Assistant Lecturer and Demonstrator—a value increased by the calls which have been made and are being made upon the department to assist in special work arising out of the war.

EVIDENCE ON FACTORY LIGHTING.

An indication is given to-day of the evidence of the witnesses examined at the third and fourth sittings of the Home Office Departmental Committee on Lighting in Factories and Workshops. When the Committee resumed their sittings after hearing the evidence outlined in last week's issue [*ante*, p. 98], the first witness examined was

Mr. *Albert Stokes*, Chief Inspector of the South Metropolitan Gas Company. He said that Mr. *Somerville*, who appeared with him, had been making some tests for them at various factories and workshops which the Company had lit with gas. At that time [May, 1913], witness said, the Company had contracts running for more than 250 factories and workshops, in which were installed some 10,000 lights. In these cases they contracted to supply and keep the burners in good condition, and to maintain the illumination at the standard which the employer required. The industry carried on in South London was principally the manufacture of domestic requirements and clothing. There was also a small amount of engineering. The Company undertook a great deal of fitting work in connection with the lighting of these factories and workshops. During the last six or seven years, they had made it their business to get in touch with the different places; and where there had been defective gas lighting, they had suggested improvements. The Company had always reckoned for the guidance of their people that some standard of illumination should be provided to enable them to say whether or not the factories were well lighted. What they had done was to assume that, before they could say a place was not badly lighted, it was necessary that a minimum illumination of 3 foot-candles should be provided on all objects which were being worked upon, or upon the operation which happened to be going on. This had always been the minimum standard of illumination; and it was found necessary in a very large number of factories and workshops to provide light considerably in excess of this. It was the opinion of his Company that the basis of specifying illumination should be the illumination on the object, rather than the taking of the candle power of the unit by which the place was lit, and measuring the distance from the unit on to the object which was illuminated. Employers were particularly anxious to get the very best light they possibly could. In fact, the Company had never found the slightest difficulty in persuading owners of factories and workshops to light their premises efficiently, or to bring their systems up to date. Many had said that they could get more work turned out if the light was good and pleasant to the operator. He thought they would be inclined to agree to a general regulation specifying the maximum or minimum illumination. The minimum of 3 foot-candles of which he had spoken generally satisfied the workers. Complaints of insufficient light were frequent and well-founded if the lighting was such as to give less than 2·5 foot-candles. A great many trades, of course, required very much more light than the 3 foot-candles. There was, for instance, a firm of theatrical costumiers, where the illumination given on the operators' bench was 6·5 foot-candles.

Replying to members of the Committee, witness said that trouble sometimes arose with regard to the position of the lamps, in the matter of throwing shadows over the work. If the Company submitted to a factory owner a design which was approved, and the lights ultimately proved to be not in a good position for the worker, the Company always undertook to alter them free of expense. The gas light they installed was entirely on the incandescent system. The colour and texture of the surface of work were important considerations as regarded the amount of light required for a given purpose. Asked if he had any suggestions to make to the Committee as to conditions in which exceptional difficulty might arise in carrying out any normal standard of illumination, witness said he had not; but he thought there would be a considerable number of these cases. If a low minimum standard of illumination were fixed, there were some factory owners who no doubt might be inclined to accept the minimum as the correct amount to provide. Factory owners were, however, so anxious to "speed-up" their works that the majority would not be likely to think it to their advantage to keep the light down too low. It was found, again, in two factories which were carrying on the same work, a light which was considered sufficient for one, was not for the other. In the same works, if the illumination was correct when white work was going through, the result would be very different when working on something of another colour. Generally speaking, a passage was well lighted with about 2 foot-candles. Handing in photographs, he pointed to one case in which, with good surroundings and a light wall, there seemed to be sufficient illumination with 1·7 foot-candles. In the great majority of cases, his Company provided considerably in excess of the 3 foot-candles he had mentioned. This was, in fact, a minimum which was not often used. In nearly all the factories fairly fine work was going on, and really good light was needed.

Sir Arthur Whitelegge: For any given kind of work, I take it that experience of the kind you have given us would enable us to say that a certain intensity of illumination is needed. Is there any physical test which can be suggested as a standard applicable to all such, or must it be determined by experience in each individual case?

Witness: I am afraid, so far as my experience goes, it would have to be determined in each individual case. I have given you the two factories where the workers were going through identically the same process in every respect. Although this was so, one factory owner and his workpeople did not agree with the views of the other. It would be very convenient if there were some definite method of deciding what was the correct amount of illumination to give for each particular trade; but witness did not think that many people would agree with definite and fixed standards.

Then it must be left more or less a matter of opinion?—That is my experience to-day—so long as a minimum is fixed.

Answering further questions, witness said all the work he had done had been in connection with ordinary inverted incandescent gas-lights. With these, the question of proper shading required attention, if the light was within the range of vision of the operator. If the light was behind the worker, he did not think it much mattered. In some cases, they adopted a globe ground half way up from the bottom. This threw the light against the reflector, and sent it down.

A series of photographs of installations put in were then explained by Mr. Stokes; the sizes of the rooms and the amount of illumination provided being given in each case. In the machinists' room of a theatrical costumier's, the illumination between the lights on the operators' bench was 5·28 candles, and under the light 6·5 foot-candles; while in a glass-cutting warehouse the figures for the plate-glass cutters' bench were 1·87 and 2 29 foot-candles respectively, and for the sheet-glass cutters' bench 5 foot-candles in the centre, and 12·5 foot-candles directly under the light. In a box-making and colour-printing works, there was 3·37 foot-candles illumination on the feeding table to the paper cutting and stamping machine; and in another place for folding large posters, there was a light in the centre of the bench of 2·5 foot-candles. Another example showed sewing machines with 16·6 foot-candles where the actual work was being carried on; and there was a laundry—which witness said was very well lighted indeed—where the illumination distributed over the whole area was 6·58 candles. For folding and book-stitching the light in one case was 6·66 and 6 candles respectively; in the packing-room, 4·33 foot-candles. At a hatter's, there was a general illumination of 6 foot-candles; and an operator said the light was only just sufficient to work by when black or dull-coloured straws were being machined. Where black-silk hats were being worked and examined for defects, there was an illumination of 20 foot-candles on the machine table between the lights. In a carpenter's shop, the illumination on the bench between the lights was 3 5 foot-candles, and directly under the lamp 5 foot-candles; while in the assembling and finishing shop, on the bench between the lights there was 4 66 foot-candles, and nearly underneath the lamp 6·33 foot-candles. The illumination on the bench in an ironing-room of a laundry was 4·16 foot-candles. In the case of a box-making and colour-printing works lighted by incandescent electric lamps, the illumination at the workers' stand in the printing room was 0·366 foot-candle, and in the gangway between the machines 0·088 foot-candle. This was very low, but quite sufficient, because the machines were automatic, and only required light where the boy stood. A corset factory, also electrically lighted, had an illumination of 0·766 foot-candle between the lights on the sewing table, 1·333 foot-candles at the table of the sewing-machine, and 0·525 foot-candle in the gangway between the machines. Probably the colours used would be mostly light; but the illumination was very low.

Mr. *A. P. Trotter*, Electrical Adviser to the Board of Trade, who pointed out that he appeared solely in his private capacity, as the Board had no connection with work of this kind, said that he had had over seventeen years' experience of compulsory regulations; and the more he saw of them, the less he liked them. A little education on the subject, through attractively published reports of the results of further

investigations, would open the eyes of a good many manufacturers and others to the possibilities and advantages of good lighting. The side of the Committee's inquiry on which regulations might be of real value was lighting as affecting sanitation; and also if it was found that there were an appreciable number of accidents which might be prevented by better illumination, he thought regulations should be made on this head. As to glare, he considered this might be reduced, with a given brilliant source of light, by placing a white reflector behind it. The glare was in this way lessened. In the case of a powerful source of light with a black background, there was much more glare—it hurt the eyes more—than if the same light had a white background behind it. With very bright lighting, some system of shading the light from the eye was very desirable.

Mr. GASTER: If, for argument's sake, certain standards are prescribed and measurements can be made, what errors should be allowed for apparatus or individuals in the illumination of work?

Witness: In ordinary cases of steady lighting, there is no difficulty. I should say 5 or 6 per cent.; and there would not be very much advantage in going further, unless you are going to make penal regulations which say that the light must be up to so many foot-candles. In that case, I wish you joy of the last 1 per cent., in the event of any dispute arising.

You think between 5 and 10 per cent. would be accurate?—I think 5 or 6 per cent. for errors of observation, and the same for instrumental errors. I have no doubt a total of 10 per cent. would do.

Mr. *J. A. Hine*, Superintending Inspector of Factories in the North-Eastern Division, gave evidence regarding a number of processes requiring a good light; but in reply to the Chairman (Dr. R. T. Glazebrook), he admitted that he was not prepared with an exact definition of what was meant by "good." As a rule, the artificial lighting was fairly satisfactory. He could not remember when last he heard of a complaint about matters connected with illumination. If regulations were framed for a minimum standard in (say) a woollen or worsted mill, it ought to be considered that certain processes, such as spinning, required a much better light than others. He had never found any difficulty owing to bad lighting in getting about the yards of engineering works and foundries.

Mr. *Haydn Harrison*, speaking as an electrical engineer, said he had taken a considerable amount of interest in this particular question, as he did in all illuminating matters. He had found, with regard to factories, that complaints of insufficiency of artificial light came chiefly from people above a certain age; whereas the actual damage to the eyesight was more often done when the bad lighting affected the young worker, who did not complain. To a full output of work, there was no doubt good illumination was essential. He had seen in print a case referred to in connection with which it was pointed out that the output of the works was reduced by from 12 to 20 per cent. during the artificial hours of lighting. An instance was some time ago brought before the American Institution of Electrical Engineers in which a complaint occurred in a coil-winding factory that the workers were only able to wind sufficient coils at night time to earn 4s. 7d., whereas in the day time they were able to earn 8s. 4d. In regard to a general basis for illumination, he had always worked back to one unit—the necessary illumination for reading comfortably at the average time. This he had put at 2·5 foot-candles, which, of course, was high. Many people would say 1 foot-candle was sufficient for reading. For book-keeping, he said 5 foot-candles, for machine drawing (draughtsman's work), 8 foot-candles, for engraving 10 foot-candles, and for ordinary office work 4 foot-candles. For general factory lighting, where there was no local lighting at all, he had always arrived at 4-foot candles. Where there was local lighting, he calculated on a basis of 1·5 foot-candles for general lighting; and then the actual local lighting had sometimes been as high as 6 foot-candles. This was a settled American rule for ordinary factory work—speaking of engineering. In the case of brass-fitting work, he would be quite content with 4 foot-candles; but for work like iron and steel screw cutting, he generally put it at 8 foot-candles. For general lighting, with local lighting, he himself would consider 0·5 candle quite sufficient. Local lighting might be defined as the lighting of the area covered by the man working on a particular job. Foundry lighting was different from anything else. Unless there was a good shadow, it was difficult for the men to see; and with an increase in the general lighting, they wanted more local lighting. If any rules or regulations were laid down, the standard would have to be defined in terms of illumination, not of candle power. Of course, glare had a very bad effect on the eyes; but if it was tapered off—that was to say, if one had a high intrinsic brilliancy and a large reflector behind it, and tapered it off to something approaching the brilliancy of the surroundings—it did not appear to have this effect. When possible, however, he avoided any light-source in the range of vision where the intrinsic brilliancy was at all high.

Mr. *V. H. Mackinney*, Chief Engineer of Holophane Limited, said the tendency in America was to give a rather higher illumination than people were prepared to pay for in England. He gave evidence dealing with the practical possibility of complying with stated requirements as regards the provision of a certain value of illumination, and stated that he habitually executed installations on this basis—determining beforehand the illumination on the working plane that would result, and subsequently checking these values by the aid of an illumination photometer. Particulars were submitted of some installations tested in this way; and witness explained how, by a knowledge of the lamps and the type of shade or reflector employed, the desired illumination could be worked out and specified in advance. He pointed out that his Company had recently had designed in their laboratories a special line of steel reflectors for factory lighting. He also drew attention to the arrangement of lights recommended by them with a view to avoiding glare and unduly dense shadows, such as might be inconvenient to workers and productive of accidents. There was, he said, a tendency in local factory lighting to give more illumination than was necessary, and therefore one got a glaring effect. There was no reason why this local illumination should not be efficiently and economically controlled, just as general illumination was nowadays.

Mr. *J. S. Dow*, representing the Illuminating Engineering Society, laid stress on the value of measurements of illumination in factories. Such measurements, he remarked, were useful in order to provide a record, which, in view of the constant progress in methods of lighting, should be in future of great value to the Home Office; as a help to inspectors in studying installations, and thus gradually establishing standards; and ultimately as a means of testing the lighting in workshops, and ascertaining whether it came up to the requisite standard, when this was provided. A number of simple and convenient instruments for this purpose had been designed. He was strongly of opinion that measurement of the illumination in a room was preferable to specifying the candle power of lamps. Tests carried out by him showed that in well-lighted libraries a minimum reading illumination of from 2 to 3 foot-candles was found to be very usual. It might be desirable to specify ultimately a minimum value of general illumination, applicable to all workshops, and fixed with a view to providing sufficient light to prevent accidents, and also to specify the local or actual illumination required on the work in various trades. The general figure might be in the neighbourhood of 0·25 to 0·5 foot-candle; but he imagined that the special illumination would have to be fixed by experimental investigation in each trade. The latter should be measured on the spot where the light was actually needed; the former was usually taken in a horizontal plane 1 metre above the ground. In addition, an instrument intended for factory lighting should preferably be adapted to the measurement of surface brightness. It might be possible for the clothing trades, &c., to adopt a standard material having a given co-efficient of reflection, and to state the illumination needed for stuff of this kind, and to make an allowance for other materials grouped approximately according to their reflecting power. The amount of reflection derived from light walls and ceilings was a factor that should if possible be recorded when particulars of a lighting installation were being taken.

Mr. *H. J. Wilson*, Inspector of Factories, gave evidence as to accidents resulting from inadequate lighting, but chiefly relating to shipping. Referring to iron and steel works, however, he said he thought he was also within the mark in claiming that a certain proportion of accidents occurred through inadequate lighting, though the lighting of factories now was infinitely better than it was ten years ago. Speaking of light and the eyes, he remarked that a man was very rarely injured by a thing that he was gazing at. It was usually something which approached him from some other direction which caused the injury. It was the faculty for seeing an object which one was not actually gazing at at the moment that was important.

COAL TAR AND ITS DISTILLATION.

[Extracts from the "Iron and Coal Trades Review," Oct. 15.]

Of the many effects which the war has had upon commercial and industrial enterprise, one of the most important is that of compelling a better consideration of the possibilities of tar distillation, combined with the fractionization and rectification of the distillates. At gas-works considerable progress certainly has been made during recent years, though even there the subject has not received the attention it warrants, while at coke-works, with one or two exceptions, practically nothing had been done prior to the war. At such works, coal tar has hitherto been regarded merely as a valuable source of additional revenue incidental to the production of coke; little attention being paid to the extremely valuable products obtainable from it. There is no branch of chemical technology which can offer better returns for capital invested than that of the working-up of coal tar and its products.

Tar, of course, varies considerably in quality and quantity per ton of coal distilled, according to the class of coal and the temperature of distillation. It is an exceedingly complex substance, consisting of a mixture of more than two hundred different chemical compounds. For the moment, however, we may consider simply a few of the intermediate products obtained by a limited number of operations on coal tar. The figures here given are representative of an average tar; the quantities stated being obtained under everyday working conditions, and do not represent simply laboratory experiment results.

The primary distillation of one ton of average gas tar will produce approximately:

Ammoniacal liquor	5 gallons
Crude naphtha	5·6 ,,
Light oils	26 ,,
Creosote oils	17 ,,
Anthracene oils	38 ,,
Pitch	12 cwt.

Following upon the introduction of the continuous process of tar distillation, many tar producers have erected plant at their own works and are profitably distilling tar—the continuous process offering marked advantages in comparison with the older intermittent process. The following working costs of the continuous process, based upon results actually obtained in a plant dealing with 6000 tons per annum, will be found instructive and interesting:

Working Cost per Ton of Tar Distilled.

	s.	d.
Fuel	1	0
Labour	3	1
Interest and depreciation		10
Other charges		5
	5	4

The values of the products obtained from one ton of tar, based upon normal prices at the time being, were:

			£	s.	d.
5·6 gallons of crude naphtha	at 7d. per gallon			3	3
26 ,, light oil	5d. ,,			10	10
17 ,, creosote oil	4d. ,,			5	8
38 ,, anthracene oil	3½d. ,,			11	1
12 cwt. of pitch	2s. per cwt.		1	4	0
			2	14	10
Less working charges				5	4
Net selling value			2	9	6

In the period under notice crude tar was worth 35s. per ton; so that the balance in favour of distillation was 14s. per ton, which represents a net revenue increase of £4200 on the year's working.

In the continuous process of distillation there is no ground for the prevalent idea that tar distillation is an intricate and offensive process. Neither is it necessary to employ men for supervising the plant who have had previous experience of distillation. The trouble of offensive vapours is entirely non-existent. Also, in normal periods there is always a ready demand for the primary products.

Perhaps it will be of interest to further consider the treatment applicable to the various distillates for the production of the refined or semi-refined products for which there is a continually increasing demand. Among such products are:

(1) From crude naphtha and light oils: 90 per cent. benzol used for motor and chemical requirements; solvent naphtha used in the rubber industries; toluol used for chemical and explosive purposes.
(2) From creosote oils: Carbolic acid for disinfectants, explosives, &c.; cresylic acid for disinfectants and chemicals; naphthalene, for coal-tar colours and other purposes; creosote light oils for disinfectants and wood preserving.
(3) From anthracene oils: Creosote for timber preserving and other uses; anthracene for colours; alizarine, &c.

The products enumerated under item (1) are contained in the first two fractions obtained in the continuous plant, and can be separated therefrom by additional plant of very simple design. One ton of average tar will, from the crude naphtha and light oils, yield: 2·5 gallons of 90 per cent. benzol, 2 gallons of crude toluol, and 5·5 gallons of solvent naphtha. Therefore, the rectification of the naphtha and light oils produced from a 6000-ton plant would yield:

		£
15,000 gallons of	90 per cent. benzol at 1s.	750
33,000 ,,	solvent naphtha at 1s.	1650
12,000 ,,	crude toluol at 1s. 2d.	700
		3100

Rectification on the continuous system is a very simple process, and calls for no special knowledge in its manipulation; the operation being well within the capacity of a man of average intelligence. The plant delivers automatically and continuously crude benzol, crude toluol, and solvent naphtha. The working cost per 1000 gallons of crude oil distilled is as follows:

	£	s.	d.
Fuel		11	0
Labour		18	0
Interest and depreciation	2	2	0
Other charges	1	2	0
Total	4	13	0

On the 60,000 gallons, the working charges would therefore be £279. The value of the crude naphtha and light oils (60,000 gallons) before distillation would be £1500; and the value of the 90 per cent. benzol, solvent naphtha, and crude toluol obtained by distillation, after deducting working costs (£279), would be £2821—showing a net profit of £1321 on distillation and purification.

Referring to group (2) of the above mentioned products, one ton of average tar contains 3 gallons of crude carbolic acid, 3 gallons of crude cresylic acid, and 112 lbs. of naphthalene (crude). The 6000 tons of tar will, therefore, contain:

	£
18,000 gallons of crude carbolic acid at 1s. 6d.	1350
18,000 gallons of crude cresylic acid at 1s.	900
300 tons of crude naphthalene at 30s.	450
	2700

For the recovery of the tar acids (crude carbolic and cresylic acids) a very simple type of plant is required, in which the middle oils are washed with caustic soda which chemically combines with the tar acids, forming sodium carbonate and sodium cresylate. By heating the latter with waste carbolic acid gas, the tar acids are separated. The plant is generally arranged so that the carbolic and cresylic acids may be obtained separately, and the working costs are calculated upon this arrangement:

Cost per Gallon.

Fuel	1d.
Labour	2½
Interest and depreciation	2
Other charges	½
Total	6

It will thus be seen that, after deducting working costs (£900), the acids have a net selling value of £1350. Assuming the middle oils were disposed of after the first process of distillation, the value of the tar acids would certainly not have exceeded £750. The net gain due to the separation would, therefore, be £600.

Naphthalene in its crude form is used for agricultural insecticides, fire-lighters, &c. It is, however, recovered without difficulty by cooling the various distillates in a suitable apparatus, when the naphthalene separates out in the form of yellow crystals, which are freed from enmeshed oil by suitable means, producing crude naphthalene. As an average tar contains approximately 5 per cent. of naphthalene, the 6000 tons of tar would yield 300 tons of naphthalene valued at 30s. per ton, or £450, which, after deducting working charges at 4s. per ton (£60), would give a net value of £390. If sold with the original oils, the value would be about £200; so that the profit due to distillation is equal to £190.

There is perhaps nothing particularly noteworthy as to the financial results of the process; but when dealing with the various coal-tar dis-

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tillates it is found a convenience to separate the naphthalene, in order to prevent blockages in pipes and passages. It may be pointed out that, owing to a shortage in supply, there is an excellent market for pure naphthalene; and as this product is worth approximately £18 per ton, there is a good margin on the refining process.

Anthracene is contained in the heaviest portion of the distillates obtained from the first distillation process. The yield is about 12 lbs. of 30 per cent. anthracene per ton of tar distilled, equal to 32 tons on the 6000 tons of tar; and the net value after deducting the charges would be about £80.

After having isolated the various materials previously referred to, the residuum is creosote oil; so that there are no working charges to be set against the creosote. As one ton of tar will produce 42 gallons of creosote oil, partly obtained from the creosote oil fraction and partly from the anthracene fraction, the 6000 tons of tar would produce 252,000 gallons of creosote oil, which at 3½d. per gallon is equal to £3675.

In summarizing the various working results here referred to, the following figures are worth very careful consideration. It should be further noted that the selling values are in every instance based upon the normal prices ruling in 1913:—

Value of 6000 tons of crude tar at 35s.	£10,500
Value of products of 6000 tons of tar after preliminary distillation process	14,850
Net value of products obtained by rectification of primary coal tar distillates as shown:	
15,000 gallons 90 per cent. benzol	2,821
33,000 gallons solvent naphtha	
12,000 gallons crude toluol	
18,000 gallons carbolic acid	1,350
18,000 gallons cresylic acid	
32 tons anthracene	80
300 tons naphthalene	450
252,000 gallons creosote	3,675
3600 tons of pitch at £2	7,200
Total net value	15,575

It will thus be seen that there is a net difference in revenue of £5075, due to the process of distillation as opposed to selling the crude tar.

As already stated, these results have been obtained under every-day conditions; and they have been amply substantiated in plants actually at work dealing with a combined output of 50,000 tons per annum; and when it is further stated that the complete cost of plant, including necessary buildings to effectively carry out the processes referred to, should not exceed £6000, it is obvious the subject might well receive the serious consideration of all tar producers.

[For the foregoing figures and the data our contemporary acknowledges indebtedness to Messrs. Hird, Chambers, and Hammond.]

BIRMINGHAM GAS-WORKS EXTENSIONS.

Further Plant for Nechells.

In a report which is to be submitted to the Birmingham City Council at their meeting to-day, the Gas Committee state that the requirements of the large number of local firms engaged in the production of munitions and war material are rapidly increasing, and make a heavy strain on the resources of the gas-works. Many of the firms are working day and night. The output of gas for the six months ended September was 13¾ per cent. greater than in the corresponding period of last year; and the demand is steadily increasing. It is not limited to the city, but extends to the important industrial towns of Wednesbury and Darlaston, which are also supplied with gas by the department. In these towns also many firms are employing double shifts in the production of munitions of war. The Committee therefore find it necessary to instal further carbonizing plant at once; and they propose to fill up No. 2 retort-house at the Nechells works.

When the erection of the retort-house and the installation of plant at Nechells was contemplated, the Council, in December, 1902, approved of an application to the Local Government Board for power to borrow £165,000 to cover an equipment of the daily capacity of 5 000,000 cubic feet. The sanction of the Local Government Board was received in June, 1903, and subsequently a retort-house was erected at Nechells, and plant installed which absorbed the greater part of the above-mentioned sum. It was not then necessary to erect all the plant originally contemplated; and consequently there still remains a balance of £35,000, which the Committee propose to apply towards the expenditure involved in installing the further plant now required to meet the probable demands of the manufacturers during the coming year. It will, however, be necessary again to ask the Local Government Board for their sanction to the application of this money, and also to obtain leave from the Treasury to raise the loan. They accordingly recommend that the Finance Committee should be instructed to obtain the necessary sanctions of the Government Departments, and borrow the sum of £35,000.

PUBLIC LIGHTING OF WESTMINSTER.

The Westminster City Council, at their meeting last July, approved and adopted a temporary arrangement [particulars of which were reported in the "JOURNAL" for Aug. 3, p. 254] with the Gas Light and Coke Company, for continuing the public gas lighting of the city after Nov. 15 next, the date of the expiration of the existing contract, subject to a report by the Works Committee on the extent of light reduction to be effected.

At the meeting of the Council last Thursday, the Committee reported

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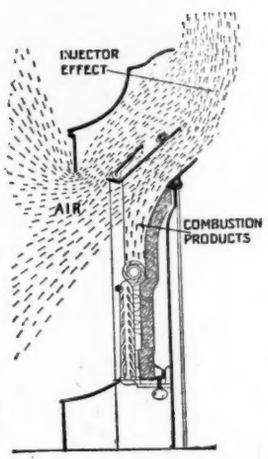
for embodying our 1915 perfectionments—these are all included in the entire range of our existing standard patterns, from the cheap 10-inch Fire of 25/- list price upwards.

We expressly avoid reverting to the discarded system of perforations in the stove-body, where dust may collect.

The ventilating air is drawn from all points of the room.

It is passed through the hottest part of the stove, so avoiding all possibility of high-temperature convection.

There is no admission of air-currents in such a way as to cool down the whole stove-body, on which we count for that proportion of low-temperature convection, the indispensableness of which we have all along emphasized.



JOHN WRIGHT & CO., ESSEX WORKS, BIRMINGHAM.

that they now propose that the general standard of light in all the units at present supplied by the Company be reduced to two-thirds of the minima stipulated in the expiring contract. The alterations necessary to secure this reduction will be made by the Company without charge to the Council. The following table shows the rebate to be allowed on each class of lamp under the proposed arrangement :

Expiring Contract.		Proposed New Temporary Contract.	
Candle Power.	Price per Lamp per Annum.	Candle Power.	Price per Lamp per Annum.
	£ s. d.		£ s. d.
90	2 16 6	60	2 6 6
180	4 10 0	120	3 10 0
300	6 10 0	200	5 0 0
1800	15 10 0	1200	12 10 0
3000	22 0 0	2000	17 0 0

Subject to an addition or deduction of $3\frac{1}{3}$ per cent. for every 1d. by which the standard price of gas for private lighting may exceed, or be less than, 2s. 6d. per 1000 cubic feet. The cost of the public gas lighting under the expiring contract is £13 496 per annum; and the cost under the amended contract, at the proposed scale of charges, is estimated by the City Engineer approximately at £10 745 per annum. The total estimated saving will thus be £2751 per annum, without regard to any further reductions consequent on future Government orders. On further reductions, the following allowances will be made.

Candle Power.	If not Lighted.	If Reduced		
		By One-Half.	By Three-Fifths.	By Two-Thirds.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
60 each .	0 16 8	0 8 4	..	..
120 ,, .	1 13 4	0 16 8	..	1 2 3
200 ,, .	2 13 4	1 6 8	1 10 0	..
1200 ,, .	5 6 8	2 13 4	..	..
2000 ,, .	8 13 4	4 6 8	..	5 15 7

Subject to an increase or decrease of $6\frac{2}{3}$ per cent. for every 1d. increase or decrease in the price of gas above or below 3s. per 1000.

The report was adopted.

The Nautilus Company, Limited (owned by the Davis Gas-Stove Company, Limited), have recently been entrusted with the interior decoration of the new show-room of the Blackburn Gas Department, of which Mr. A. Morton Fyffe is Engineer and General Manager.

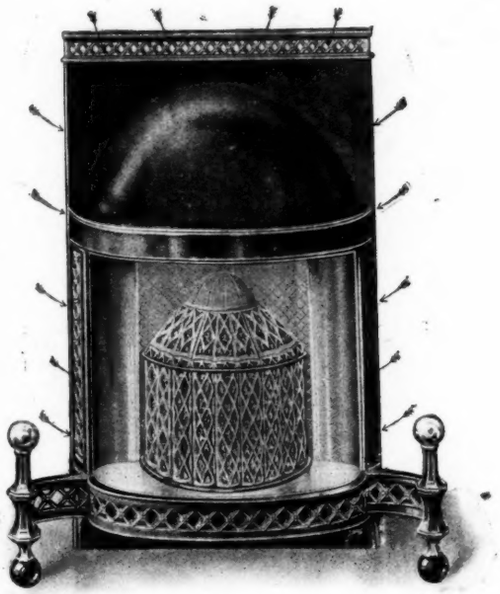
KEIGHLEY GAS-WORKS RESULTS.

The accounts of the Keighley gas undertaking for the year ended June 30, which were submitted to the Town Council on Tuesday last, showed a gross profit of £11,313, and a net profit of £1832. Inasmuch as £2985 was to be transferred to the general district rate, there was a deficit of £1153 ; but as £5855 stood as a credit balance last year, this left a surplus of £4702. From this, a donation of £50 was recommended to be handed over to the Keighley Victoria Hospital. The gas made amounted to 399,495,000 cubic feet, equal to 12,568 cubic feet per ton of coal carbonized ; and the average price received for gas supplied by meter during the year was 1s. 9 9d. per 1000 cubic feet. There had been an increased sale of 12,000,000 cubic feet of gas, realizing £1316.

Mr. J. HARRISON (the Chairman of the Gas Committee), in moving the adoption of the report and accounts, said the war had seriously affected the usual smooth working of most gas undertakings, and considerably depleted profits. Their own undertaking had borne its share of the depressing conditions. In the estimates of the year's working under review, the total gross receipts were put at £52,131, and the expenditure at £38,784 ; whereas actually the income was £50,521, and the expenditure £39,208. The receipts from coke were less by £1243, and from tar by £1498 than estimated for ; but the increased receipts from gas had considerably reduced this deficit, leaving a total of £1610 less than in the estimate. During the last six months of the year, vitriol for the manufacture of sulphate of ammonia] went up in price by leaps and bounds, until eventually it reached almost double its former price. This seriously affected the net revenue derived from sulphate of ammonia sales. On the expenditure side, £424 had been overspent. Owing to various causes, coal supplies were delivered in small quantities ; and this forced the Committee to buy 1000 tons for immediate delivery at 6s. 6d. per ton advance, to ensure an adequate supply of gas to the town. This purchase alone represented £300, and if added to the extra charges against the department for war bonus (£112) and active service allowance (£207) made a total of £619. The increased charges for rates and income-tax further added to this total. But against this a very notable saving had been effected in purifying account, totally eliminating the charges formerly entered against naphthalene. Taking everything into consideration, the Committee considered the report very satisfactory. It might interest the Council to know that 20 per cent. of the gas made was being used by firms at work directly or indirectly on war materials for the Government. Also at the works arrangements had been made for extracting toluene from the gas. This process had been operated a considerable time.

Mr. LONGTON said the debt on the department was a comparatively small one—£48,748. They had a working capital account of £15,000, a suspense fund of £4652, and a renewals and insurance fund of £5207 ; giving a total of £24,859. For many years they had had funds amounting to £35,000 or £37,000 ; but they were spending out of these

The Twin Principles of the "R.H.D."



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THE RICHMOND
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funds on other work. The department had difficulties to face, and one of them was in regard to interest. They had received in interest as much as £989—last year it was £722—but when their balances were spent there would be no interest to take into account. They had spent £16,906 on a new gasholder, and about £21,000 was being spent on new carbonizing plant. One of the curious things was that during last year coal cost £545 less than the previous year. Dealing with the increase of 5d. per 1000 cubic feet in the price of gas, he said the increased cost of coal—6s. per ton—represented something like £9535; whereas the increase in the price of gas only represented roughly £7488. It was stated in the report that the increased revenue from coke would probably cover this. It was rather a sanguine estimate, and he hoped it would turn out all right. They had dropped on lean times, so far as the gas-works were concerned. They had practically no money for the relief of rates; and the balance would soon be practically non-existent. Attention should now be given to the question of leakage, which seemed to him to be very large.

The report and accounts were adopted.

NOTTINGHAM GAS-WORKERS' WAGES.

Negotiations, the outcome of which at one period threatened potential danger to the continuity of efficient working in connection with the Nottingham Corporation gas undertaking, were brought to a conclusion on Friday.

There had been for some time portents of a storm; the activities of the officials of the Gas Workers and General Labourers' Union being persistently in evidence. A notable circumstance was the frequent visits of Mr. Will Thorne, M.P., the founder of the organization. To such dimensions had the undercurrent of disaffection been stirred, that there were ominous rumours that, after the Leeds *débâcle*, Nottingham might become the new battling ground. Originally, the City Council had agreed upon a comprehensive resolution, which took within its scope all the departmental workmen earning wages under 32s. a week; the decision arrived at being to grant a war bonus of 2s. to male employees who are married, to the single men over military age, and to the single men of military age ineligible for military service, and in receipt of 30s. and under per week. The resolution of the Council also provided that in the case of men receiving over 30s. and under 32s. weekly, the amount of their wages should be supplemented by such a sum as would raise the total to 32s.; the provision being that this additional sum should be paid as long as the war bonus is in operation. But the trade union extremists, through the influence of the organization which Mr. Thorne controls, quickly manifested their chagrin by the determination to bring a wider class within the fold. Their application was for the inclusion at the enhanced rates of those already in receipt of 32s. or a larger amount weekly, with the result that incidentally it was sought to establish that gas workers came for arbitration purposes within the scope of the Munitions Act.

The upshot of the matter has been that, following upon interviews during the last few days with Sir George Askwith in London, at which the cases on behalf of the Corporation and the workmen have been presented, the Gas Committee, at their meeting on Friday morning, acquiesced in the suggestion emanating from the Chief Industrial Commissioner that the increase in regard to the class of employees specified should be upon the basis of 2d. per day or shift. This met with the acceptance of the trade union leaders, who, however, made it a *sine quâ non*, that the same terms should be extended to the workers in the Electricity Department. Meeting at a later period of the day, the Electricity Committee agreed to act in consonance with the decision of the Gas Committee; and thus the matter has been settled, upon terms properly disproportionate to the inflated demands originally put forward.

COKE FUEL FOR STEAM-WAGGONS.

An account was given by Mr. G. W. Watson, Consulting Engineer to the Commercial Motor Users' Association, in last Wednesday's "Journal of Commerce," of the demonstration steam-waggon run from Wandsworth to Epsom, which was referred to in the "JOURNAL" for the 12th inst., p. 93. It may be pointed out that the comparative figures are based on a more favourable price for coal than for coke. Mr. Watson says:

Of the two Foden waggons, one is over three years old, and has been run entirely on coke fuel ever since it was new; the other waggon is not quite two years old. Both waggons, with their loads and trailers, were up to the legal limit of 20 tons gross. The coke consumed was carefully weighed, and the consumption over the give-and-take roads was 15¼ lbs. per mile run on the older machine, and 17½ lbs. on the other one—an average of 16¼ lbs. per mile, or 0·8125 lb. per gross-ton-mile. The only point of difference between the two waggons and a standard Foden is the spacing of the fire-bars, which, for coke firing, have about 45 per cent. of air-space. The fire, too, is about double the depth one would allow with steam coal—that is, the top of the fire was only about 1½ inches below the bottom of the fire-door.

As a means of comparison with the above figures, let me take the admission of several users who were present at the trials, and whose vehicles regularly travel over the same road. With a gross load of 17 tons they find the rate of consumption of good Welsh coal averages 1 cwt. per 10 miles, which is equivalent to 11·2 lbs. per mile, or 0·66 lb. per gross-ton-mile. Resolving these figures into cost per vehicle mile and per gross-ton-mile, let me assume that coal costs 40s. and coke 25s. per ton. This being the case, the costs for coal fuel are 2·4d. per mile travelled, as against 2·18d. for coke, and 0·141d. per gross-ton-mile for coal, as against 0·109d. for coke.

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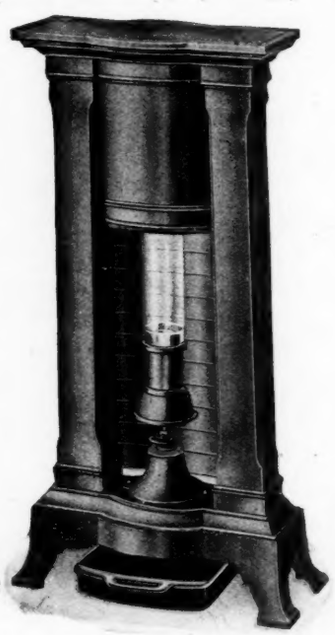

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Of course, there are other considerations than cost of fuel. For instance, there is the relative bulk to be taken into account, as well as the greater tendency of coke to form clinker. But the latter objection has now been overcome by the use of a form of fire-bars which, without any mechanism, and merely by the vibration due to running, are kept gently rocking. True, coke is not the ideal fuel; but it is a possible alternative, and as such its use should not be entirely ignored. Many Lancashire waggon-owners have used it for years, and could not be persuaded to change.

The Editor of the "Commercial Motor," writing on the same matter, says: Coke is more favoured in the North of England, and its use is not uncommon there, chiefly because of the lower prices at which it can be bought. The relative values of coke and coal, in the writer's experience, may be stated as follows: 15 lbs. of coke are necessary, in practice, to do the same work as 10 lbs. of a good Welsh steam coal; coke at 25s. a ton is, therefore, equal to the best coal at 37s. 6d. Gas companies in the South will require to treat owners of steam-waggons and tractors on a liberal basis, in order to encourage the consumption of coke. The same prices which rule for orders from householders cannot be adopted. There is in force, at the present time, at least in London and the vicinity, a scale of discounts according to consumption that seldom exceeds 15 per cent. on standard prices; and standard prices just now are unusually high. This uncommercial scale will not bring to the gas companies the business for which they are looking. We urge them to adopt a more generous table of discounts, varying with the consumption of the individual buyer, and going, in the case of the largest consumers who own fleets of steamers, up to at least 30 per cent. They have a precedent set them by the large petrol importing companies, and these companies are controlled by astute minds. The large consumer must have consideration; and especially is this true if he is being urged to change from a fuel to which he and his men are unaccustomed, or to revert to one which they have abandoned. The advocacy of coke, which is being systematically taken up by the London Coke Committee, and of which policy we find echoes in different parts of the country, cannot be divorced from considerations of economy to the owner of a steam waggon or tractor.

With reference to Mr. Watson's figures, it is pointed out that it should be noted that the coke consumption was determined on the outward journey only, under full-load conditions. This has been set against the average out-and-home coal consumption, with consequent advantage in favour of coal. The Wandsworth Gas Company's previous experience with coal has now been confirmed by further coal-consumption trials, with the waggons used on the demonstration, under exactly similar load, time, and road-surface conditions. Although these latter trials are not yet completed, the results so far go to show that the actual coal consumption is little, if any, less than that of coke. Various grades of Welsh coal, varying in cost from 40s. to 45s. per ton, are being used for the purpose of comparison; and the original coal-burning fire-bars have been temporarily re-fitted to the cars being experimented with.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

A conference was held last week in the City Chambers, Edinburgh, between the representatives of the Town Councils of Edinburgh and Leith and the coal merchants in regard to the question of coal prices. The subject has been brought to the notice of the leading local authorities in Scotland, in order that, if possible, some steps may be taken to limit prices. There were also present representatives from the Glasgow Corporation Committee on Coal Prices, and of the coal merchants. The proceedings were private; but it is stated that there was a free interchange of opinion, and the question of margin came in for a good deal of discussion. The Glasgow representatives indicated what was being done in the West of Scotland; and it was ultimately agreed to adjourn the conference till next Thursday, when it is expected a decision will be arrived at.

Mr. James Purves, the Manager of the Ayr Gas-Works, has been fined £5 on a charge, to which he pleaded guilty, of having failed to obscure a light in the works which was visible from the sea. There was a dark curtain over the window; but as there was a space of some inches at either side, it did not obscure the light effectually. In addition, the curtain blew about, and thus gave to the light a flashing effect which, it was urged, "might very easily have been mistaken for signalling." It transpired that the light arose in connection with the "burning-out" of some retorts, and that Mr. Purves had taken every precaution he could think of against possible infringement of the Lighting Order.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Oct.* 18.

There are no new features to report in the London tar products market. Pitch is in small demand, except at prices which do not interest manufacturers. The feeling is prevalent, however, that it will be a good investment to hold pitch in stock, as at the present time shipowners would obtain by way of high freights a large slice of the value of pitch which should go to the tar-producer and tar-distiller.

The position of sulphate of ammonia is increasingly strong; and in view of the situation, makers are shy about quoting. For prompt delivery, possibly some might be bought at £14 15s. net per ton, filled into buyers' bags *ex* works, for 25 per cent. quality.

Tar Products in the Provinces.

Oct. 18.

Markets for tar products remain in about the same position. No business of importance is reported in pitch. Although some quantity

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Old Broad St., E.C.

is offering in London at 20s. per ton, there are no buyers at this figure. Creosote is very quiet and difficult to sell. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 19s. 9d. to 23s. 9d. Pitch, East Coast, 19s. to 20s. per ton; Norfolk, Suffolk, and Humber ports, 18s. 6d. to 19s.; West Coast, 19s. to 20s. Manchester; 20s. to 21s. Liverpool; 20s. to 21s. Clyde. Benzol, 90 per cent., North, 10½d. to 11d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 2d. to 2s. 4d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅞d. to 3d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 5d. to 3s. 6d. Naphthalene, £18 to £28; salts, 75s. to 85s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Oct.* 16.

Although the inquiry from abroad has remained on a limited scale, dealers in the United Kingdom have continued to compete keenly for all available supplies; and a further substantial rise in values has been recorded during the past week. The prices for prompt delivery are now £15 per ton f.o.b. Hull, £15 2s. 6d. f.o.b. Liverpool, and £15 5s. f.o.b. Leith. For future delivery, higher figures have also been paid, and it is reported that first-hand business has been done at the principal ports at £15 5s. per ton for November-December, and £15 10s. for January-March.

Nitrate of Soda.

The market for this material has advanced rapidly, and holders on spot now require 14s. 3d. per cwt. for ordinary, and 15s. 3d. for refined quality.

Sulphate of Ammonia.

From another source it is stated that the market for this article has remained fairly firm throughout the past week. Outside London, makes are quoted at £14; Hull, £14 10s.; Liverpool, £14 12s. 6d.; Middlesbrough, £14 10s. to £14 12s. 6d.; Leith, £14 15s.

Bomb Damages a Gas-Main.—During the proceedings at an inquiry yesterday into the deaths of 23 victims (all in one district) of last Wednesday night's Zeppelin raid on London, a police inspector said one of the bombs dropped "made a hole 9 feet in diameter. One of the gas-mains was struck, and the fusing of electric wires caused a fire which took until five o'clock the next evening to put out, because the main had to be cut. But no real damage was caused, though the buildings all round were damaged."

COAL TRADE REPORT.

Northern Coal Trade.

There is a steady demand for coals, both for steam and gas qualities. For early supplies, there are firm prices; but forward deliveries vary more. In the steam coal trade, the demand is good for all but smalls. Best Northumbrians are from 19s. to 19s. 6d. per ton f.o.b.; second-class steams are about 16s 6d. per ton; and steam smalls are from 11s. 6d. to 14s. per ton f.o.b. More steam coal is being shipped—licences having been given more freely. Thus the output has been taken up well, though high freights to some extent interfere with business. In the gas coal trade, the demand increases steadily, and a good request for bunker coals helps to stiffen prices of other qualities of Durham fuel. Best Durham gas coals are 19s. per ton f.o.b.; second-class gas coal is about 16s. 6d. to 16s. 9d. per ton; and "Wear Specials" are 20s. to 20s. 6d. per ton f.o.b. Some sales are being made forward; but the high freights make values of delivered coal quoted very high. Gas coal from the Tyne to London is about 9s. 3d. freight, and to Rouen 18s. 6d. is quoted. The prospect, therefore, of freights for winter is not bright; but it needs to be added that the "coasting traders"—the interned steamers—are lower than the figures just given. At present it is worth note that the steamers are making more regular voyages than they were, so that the coal deliveries on the long contracts are fairly good. There is not much change in the coke trade; and, with a fuller production, stocks have increased in some directions. Good gas coke is from 29s. to 30s. f.o.b. in the Tyne. The home inquiry for gas coke is steady; but the exports have been rather lower from some ports.

In connection with the Blackburn Corporation Gas Department, Mr. Thomas Hannibal, of the Secretary's department of the Smethwick gas undertaking, has been appointed Chief Clerk; Mr. C. W. Ward, of Retford, is to be Works Superintendent at the Greenbank works; Mr. E. Harrison, of Rochdale, has been appointed to take charge of the new gas show-rooms which are shortly to be opened; and Mr. J. H. Clegg, of the Aldershot Gas and Water Company, has been given the position of Chemist and Draughtsman.

A meeting of ratepayers of St. Columb last Wednesday confirmed the action of the District Council with regard to the public lighting. This was to terminate the contract with the Gas Company at the expiration of three months. The Company agreed for a term of three years to light the district for a specific sum; and the Council, consequent upon the receipt of a letter from the Local Government Board urging the practice of economy, asked the Company to extinguish the lamps at an earlier hour. The Company, however, replied that the provisional arrangement made with the Council was on the distinct understanding that there was to be no curtailment. The Council persisted, and then received notice from the Company to determine the contract at the expiration of three months.

REMEMBER, when ordering GAS FIRES,

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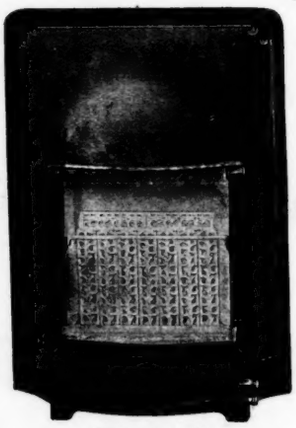
Distinction Gained for Efficient Service.

FIRST In 1906 **FOR RADIANT EFFICIENCY** in Official Smoke Abatement Tests.



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Liverpool Water Supply.

Colonel Porter, in acknowledging a vote of thanks passed to him in his capacity as Chairman at the closing meeting of the Liverpool Water Committee for the municipal year, gave his customary brief review of the work of the past twelve months. During the year, the total quantity supplied from all sources was 14,464,575,000 gallons, an increase on the previous year of 343,951,000 gallons. The average rate of consumption per day was 39,738,000 gallons. The quantity of water supplied in the city and out-townships was 12,619,116,000 gallons, an increase of 327,506,000 gallons on the previous year. There was an increase in the quantity of water supplied in bulk along the Rivington and Vyrnwy aqueducts of 43,544,000 gallons. There was also an increase of 67,956,000 gallons in the consumption of water by meter for trade purposes, and in shipping supplies of 17,066,000 gallons. In accordance with suggestions received from the President of the Board of Agriculture, arrangements had been made to reduce as far as possible the amount of land to be planted on the Vyrnwy area during the season 1915-16. During the year 38 more officers and workmen had left for military service, making the total number who had joined the forces 119 out of 255 of military age in the department. In addition to the men who had enlisted, there were several fitters and labourers from the water-works repair shops employed temporarily on munitions work.

Westgate and Birchington Gas Assessment.—The Isle of Thanet Assessment Committee, at the beginning of this year, fixed the rateable value of the Westgate and Birchington Gas Company's undertaking at £1568. The Company [for whom Messrs. W. A. Valon and Son act as Engineers], however, objected, and succeeded in getting the figure reduced to £750. Messrs. Ryde and Sons represented the Assessment Committee.

Coal Contracts at Sowerby Bridge.—A subject which caused lively discussion at the last meeting of the Sowerby Bridge Urban District Council was the question of coal prices. In committee it had been decided to take advantage of the Coal Prices (Limitation) Act, and the Clerk was instructed to notify the colliery owners of the fact. Mr. Longbottom pointed out that there was some doubt as to whether the Council would get a rebate on the coal now being delivered; the price per ton being higher than the figure mentioned in Parliament. They had let their contracts at a high rate; and the new Act did not come into operation until Oct. 29. At the gas-works the Council had a huge stock of coal, for which they had paid an extraordinary price; and, unless the Act was made to apply to all the new season's contract, Sowerby Bridge was going to lose a lot of money. The Chairman of the Gas Committee (Mr. J. W. Whiteley) said they would have been foolish if they had not got in a stock of coal. To have waited would have meant running the risk of having the town in darkness. Their policy was now to fight for a reduction in price for all their contracts; and this probably will be the action taken by the Committee.

Failure of Electric Current in Birmingham.—There was a stoppage of the whole of the tramway service of Birmingham last Tuesday evening, for a period of about half-an-hour, just about the time when the majority of workers were desirous of getting home. To some extent the lighting was also affected, though it did not altogether fail. The stoppage was attributed officially to a "combination of unforeseen circumstances;" two boilers having to be temporarily put out of action for cleaning, just at a time of excessively heavy demand for current.

Banwell Gas Company.—In a notice signed by the Secretary (Mr. J. H. Powell), it is intimated that, improvements and alterations at the Banwell Gas-Works having been completed, the Directors are able to offer an efficient supply of gas to every house situated in the district. Notwithstanding the heavy increase in costs of production, no advance in the price of gas is to take place—in fact, in certain circumstances a slight reduction is offered. To consumers purchasing or hiring gas cookers or fires, and using gas through ordinary meters, a special discount of 5 per cent. on their accounts will be given; and accounts due to the Company are now subject to 5 per cent. discount for cash, if paid before the last day of the month in which they are delivered.

Rockhampton Gas Company.—It was stated by the Chairman, Mr. R. C. Boland, at the half-yearly meeting of the Rockhampton (Queensland) Gas Company that the operations for the six months under review showed a profit of £3533, which, with the balance brought forward, made a total at credit of profit and loss of £6533, from which £1239 had been applied to writing-down the assets of the Company, leaving £5294 for distribution. Out of this the payment was recommended of a dividend of 9 per cent. per annum on the preference shares, and of 7 per cent. on the ordinary shares, which would leave £3500 to be carried forward. It was hoped that when the debentures were cleared off it would be possible to reduce the price of gas.

Mannesmann Tube Works under War Conditions.—According to "Engineering," the Mannesmann Tube Works in May last year effected a combine with the Schultz-Knaudt Plate-Rolling Mills; the capital at the same time being increased by 11,000,000 marks, so as to amount to 72,000,000 marks. While the Company had intended to pay a dividend of 13½ per cent. for the year 1913-14, they found it, on account of the war, expedient to reduce the dividend to 7½ per cent. The report for 1914-15 has now appeared; and it states that the Company to begin with suffered very materially from the effects of the war, and an improvement has only set in by degrees. Last November the Board were able to state that their production, which had fallen to 25 per cent. of the normal, had again risen so as to amount to 40 per cent. of the ordinary peace output. Matters have continued to mend; but although the Company also has profited by war contracts, full employment is not yet reached by a long way. The gross profits for last year amounted to 15,878,686 marks, against 16,804,197 marks for the preceding year; but the net profits were 8,120,004 marks, against 5,641,006 marks for the preceding year—the dividend being fixed at 10 per cent.

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The "HADDON" and the "CHATSWORTH"

embody the following special features:

A PERFECTLY SILENT BURNER,

NEW FUEL DEVELOPMENTS.

A specially designed **CURVED TOP FUEL** holds the upright fuel in position without the aid of the usual guard and, in combination with the specially designed brick, considerably increases the heating power.

14-in. Fire = 50s. Art Black.

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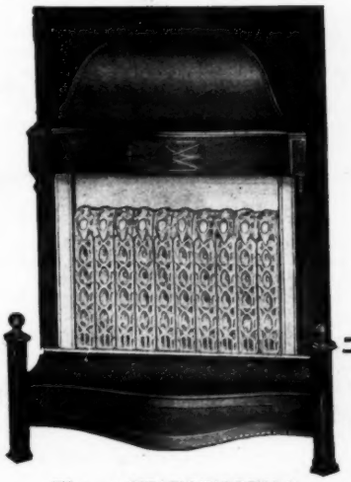

THE PARKINSON STOVE CO., LTD.,
BIRMINGHAM.

LONDON SHOW-ROOMS:
129, High Holborn, W.C.

The "HADDON." The "CHATSWORTH."

Fire at the Ash Road (Aldershot) Gas-Works.—A fire broke out early last Tuesday morning in the roof of the purifier-shed of the coal-gas section at the Ash Road works of the Aldersbot Gas, Water, and District Lighting Company; the cause of it being at present unknown. Owing to the difficulty in obtaining communication with the fire brigade—the nearest alarms being more than half a mile away—the assistance of the brigade was unfortunately delayed; but, after arrival, the fire was soon controlled. The supply of gas to the public was not interrupted, nor the plant damaged to any serious extent.

Cost of the Burnley Water Scheme.—Some big figures were mentioned at a meeting of the Burnley Town Council, when it was decided to promote a Bill for the purpose of acquiring further borrowing powers in respect of the new reservoir at Hurstwood. Alderman Keighley said the work was originally let for £158,000; and it was anticipated that the scheme would be completed well within the parliamentary estimate of £215,000, for which borrowing powers were obtained. The original contractors, however, became bankrupt after the work had been three years in progress, by which time they had received £35,000 for work done. Fresh tenders were invited; but these were considered so high that the Water Committee decided to complete the undertaking themselves, under the charge of the Engineer. Up to the end of last July, the amount spent was £175,984; and it was estimated that it would require another £151,000 to finish the scheme. There had been an enormous rise in the price of labour and materials; and the site had disclosed many difficulties not anticipated.

Lighting of Sowerby Bridge.—A vigorous protest on the part of the public of Sowerby Bridge against the lighting restrictions which have been in operation for many months, has met with success; and at the last meeting of the District Council it was decided to completely change their policy. When the minutes of the Gas Committee came up for consideration, Mr. A. F. Longbottom took the opportunity to raise the lighting question. He said that, so far as he knew, there were no restrictions which now applied to Sowerby Bridge. During the past few weeks, complaints about the darkened streets had become very numerous. There were many dangerous corners in the town; and these ought to receive attention. The Council should pay better attention to the public requirements. The Chairman (Mr. John Bates, J.P.) was in favour of a return to full lighting throughout the area. It was a military order which compelled them to restrict street lighting; and this order had not been officially withdrawn. Subject to the approval of the military authorities, it was decided to return to the old lighting arrangements.

Halifax Walshaw Dean Reservoirs.—Members of the Halifax Town Council recently visited the Corporation reservoirs at Walshaw Dean, to celebrate the accomplishment of the task of making them watertight. The construction of the reservoir was begun in 1900, and completed six years later. Afterwards, however, it was found that, owing to faults in the strata, there were serious leakages of water, and remedial works were begun. Holes were bored in the embankment, and down these liquid concrete was pumped, in order to block-up the passages eroded by the escaping water. This method was applied on an unprecedented scale, and has proved entirely successful. The cost has been about £20,000, bringing the total expenditure on the reservoirs to some £380,000. Messrs. G. H. Hill and Son, of Manchester, have been the Engineers throughout. During an interval in the inspection, opportunity was taken to present a silver salver and tea service to Mr. Mark Crossley, in recognition of his valuable services as Chairman of the Water Committee for the past nine years. The Mayor (Alderman W. H. Ingham) made the presentation on behalf of the Council, and paid a high tribute to Mr. Crossley's work.

Wolverhampton Water Act and an Honorarium.—Presenting to the Town Council the report of the Parliamentary Sub-Committee on the Wolverhampton Corporation Water Act, 1915, Alderman Marston said the town had obtained valuable powers, and, in addition, an almost inexhaustible supply of water at a much lower cost than if they had purchased in bulk from Birmingham. Mr. Evans thought they could congratulate themselves upon the Act, which had been steered through Parliament notwithstanding a bitter, strenuous, and scathing opposition. Mr. Hughes said that he found himself antagonistic to the proposal relating to the payment of an honorarium of 350 guineas to Mr. E. A. V. Woodward, the Borough Water Engineer, who had, undoubtedly, rendered excellent service. He did not think the ratepayers would look with favour upon the payment of such a large sum, especially in view of the fact that all departments of the Corporation were studying the question of economy. Mr. Sharrocks said the Council had appointed an Economy Committee, and the time was inopportune for granting honorariums. Mr. Myatt, however, expressed the opinion that the honorarium was a payment for the overtime of an expert. The Mayor said he was in favour, not only of economy, but of efficiency; and he believed the Council would be well advised to accept the report unanimously. Mr. Woodward had rendered great service; and the new water supply would be an invaluable asset for the town's future generations. The report recommending the payment of the honorarium was passed by 24 votes to 8.

APPLICATIONS FOR LETTERS PATENT.

14,084.—Thompson, T., "Gas-stoves." Oct. 5.
14,125.—Hall, I., "Furnaces" Oct. 6.
14,142.—Waddell, A., "Manufacture of coal gas." Oct. 6.
14,143.—Waddell, A., "Gas-retorts." Oct. 6.
14,148.—Jones, F. G., "Gas water-heater." Oct. 6.
14,152.—Wilson, J. A., "Elimination of sulphur compounds from benzol." Oct. 6.
14,154.—Smith, F. G., "Gas-cookers." Oct. 6.
14,155.—Fuller, W. J. H., "Gas-lamps." Oct. 6.
14,180.—Bentley, J. E., "Gas-regulators." Oct. 7.
14,186.—Davey, H., "Gas-burners." Oct. 7.
14,273.—Hunt, E. J., and Gidden, W. T., "Treatment of sulphate liquors." Oct. 8.

Nautilus Art in the Modern Gas Showroom

In addition to numerous successes already announced, The Nautilus Co. (owned by the Davis Gas Stove Co., Ltd.) have recently been entrusted with the Interior Decoration of the

Blackburn Gas Dept.'s New Showroom

(Mr. A. Morton Fyffe, Engineer and General Manager).

The marked preference for Nautilus Showroom Art thus shown by so many Gas Undertakings, amply justifies the Nautilus Co.'s policy of specialization in Gas Showroom equipment—a policy initiated so auspiciously in their fitting out of the

Davis Gas Stove Co.'s Gas Exhibition Salons, 60, Oxford Street, London, W.

Plans, Specifications, and Inclusive Estimates gladly submitted. — Inquiries welcomed.

The Nautilus Co., Ltd.

(Proprietors: The Davis Gas Stove Co., Ltd.)
60, Oxford Street, London, W.

Fatal Explosion at Beckton.—A message sent out at noon yesterday by the Exchange Telegraph Company stated that an explosion had occurred, at about 3 o'clock in the morning, at the Beckton works of the Gas Light and Coke Company. A sheet of flame was observed to shoot up in the air; and this was followed almost immediately by a terrific explosion. Flames lit up the sky for miles around, and hundreds of people living in the vicinity of the works turned out of their houses. So far as could be ascertained, only one man was killed, and another slightly injured. The flames were quickly subdued by the Company's own firemen engaged at the works, before any considerable damage had been done. Further particulars will be available at the inquest on the deceased man.

Mossley Gas-Workers' Wages Advanced.—Substantial advances in wages have been given to the employees at the Mossley Corporation Gas-Works. In March last an advance of 15 per cent. in the wages of all men employed by the Corporation was asked for by the Municipal Employees' Association; and the Gas Workers and General Labourers' Union tendered a like request on behalf of the gas workers. At a meeting held recently between the Council Sub Committee and the Secretaries of the respective Unions, certain concessions were offered on the one hand and (with slight modifications) eventually accepted on the other. The concessions were equivalent to an all-round advance of 2s. per week to all men receiving less than £2 weekly, and ½d. per hour to all men employed by the hour. The new rates will take effect as soon as the terms of settlement have been approved of by the Council; and the Council will also be asked to agree to make the concessions retrospective to July 8 last. At a meeting of the Council on Friday the recommendations of the Special Sub-Committee were approved. The advances in the Gas Department represent about £300 a year.

Workmen's Compensation Act Appeal.—On Saturday, Mr. Henn Collins applied to the Court of Appeal [consisting of the Master of the Rolls and Lords Justices Bankes and Warrington] in the case of *Strange v. Davis Gas-Stove Company, Limited*, on behalf of the defendants, that plaintiff might be ordered to give security for the costs of an appeal, on the ground of want of means, and that her address was unknown. He said the workman met with a fatal accident; and the mother's case was that she had been living with some relations, to whom the son allowed 10s. a week. An award had been made in her favour of £100; she having claimed £156. The £100, and the taxed costs, were paid into Court; and though the money had been taken out, she proposed to appeal in respect of the £56. There was not much prospect of success. Their Lordships ordered appellant to give security for £10 within fourteen days.

Gas-Fires and Guards.—In the course of an inquest at Ashton-under-Lyne on Monday of last week, a point was raised as to whether gas-stoves should have fire-guards. It was an inquiry into the death of Amy Reynard (19), who died from burns received at the Corporation Fever Hospital, where she had been a fortnight as a probationary nurse. While attending to a child in the bath-room, her clothing came in contact with the gas-stove, and she died from her injuries. The matron said there was no guard on the stove, which was of modern pattern; and the possibility of danger had never occurred to her. The stove was only lighted at intervals. The Medical Officer of Health stated that gas-stoves were installed in the hospital in 1888; and there had never before been an accident. They were now being replaced by radiators. A Juryman asked whether the law did not make it necessary to have a guard on a gas-fire. The Coroner replied that he could not give an opinion. He had seen many gas-fires, but never remembered one with a guard. A verdict of "accidental death" was returned.

GAS COMPANIES IN THE STOCK EXCHANGE.

The state of things on the Stock Exchange which has prevailed for the last few weeks took a decided turn for the better last week. Business showed a gratifying tendency to develop something like moderate activity; and the tone at the same time was really cheerful. It would have occasioned no surprise if the Bulgarian attack on Serbia and the hesitation—if not absolute defection—of Greece had exercised a depressing effect upon markets in general. But they stood unmoved. Several, indeed, pursued the path of improvement which they were treading in the previous week. Government issues were conspicuous here; and the War Loan steadily hardened and closed firm. Colonial issues continued in demand. There were some good points in the Foreign Market, especially Japanese. German 3 per cents. were very flat—changing hands more than once at about a 6¼ per cent. price. Home Rails were not supported. Canadian Pacifics made a good steady advance. South Africans were irregular; and so were Americans. In the Miscellaneous group, oil and rubber were fairly strong. Favourable reports of harvest prospects attracted attention to Argentina, Mexican affairs were regarded as more promising, and the same to a limited extent may be said of Brazil. The Finance Bill, circulated on Tuesday, of course, came in for criticism. Bankers protested strongly against being made collectors of income-tax on customers' deposits—so strongly, indeed, that the Chancellor of the Exchequer met their representatives on Thursday for discussion. Business in the Gas Market showed a decided turn for the better in point of activity, and the general tone was firm; some prices looking quite ready to advance if they could be encouraged by a little more animation being manifested. In the Money Market, the terms for short loans remained quite easy. Discount rates stiffened at first, but relaxed later.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 78, 78⅛, 78⅜, ditto preference 72½, 73, Imperial Continental 63¼, South Metropolitan 76¼, 76¾, 77. On Tuesday, European 12⅛, 12⅜, 12¾, Gas Light ordinary 78, 78¼, 78⅛, Liverpool 93½, South Metropolitan 76, 76⅛, 77, ditto debenture 60, 60½. On Wednesday, European 12¾, Gas Light ordinary 77⅞, 78, 78⅛, ditto maximum 60, 60⅜, ditto preference 72¾, 73, 73¼, Primitiva preference 3¼, South Metropolitan 76⅛, 77, ditto debenture 59½. On Thursday, Commercial 80, European 12⅛, 12⅜, Gas Light ordinary 78, 78¼, 78⅛, Newcastle 84½, South Metropolitan 76⅛, 77, ditto debenture 60¼. On Friday, Brentford "B" 85, 85½, 86, Gas Light ordinary 78, 78⅛, ditto preference 72½, 73, ditto debenture 62⅜, 63, 63½, South Metropolitan 76¼, 76¾, 77, ditto debenture 60½, 61. On Saturday, Brentford "B" 85, 85½, 86, British 37¼, Gas Light ordinary 78, 78½, 79. South Metropolitan debenture 61.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING OCT. 16.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.		£ s. d.		
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	59—64	3 18 2	..
374,000	,,	July 10	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	Bombay, Ltd.	5⅛—6⅜	5 17 8	..
50,000	10	Feb. 26	16	Do. 10 p.c.	29—30	5 6 8	..
878,480	10	,,	7	Bournemouth Gas and Water { B 7 p.c.	15—15½	4 10 4	..
95,000	10	,,	6	Bournemouth Gas and Water { Pref. 6 p.c. Deb.	13½—14	4 5 9	..
—	—	—	—		..	—	..
880,000	Stk.	Feb. 26	14	Brentford Consolidated	261—266	5 5 3	..
880,000	,,	,,	11	Do. New	204—209	5 5 3	85—86
50,000	,,	,,	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	,,	June 11	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	British	44—45	5 11 1	37¼
120,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106—108	5 1 2	80
560,000	,,	,,	5½	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	69¼—71½	4 3 11	..
800 000	Stk.	,,	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	,,	,,	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
—	—	—	—	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	European, Ltd.	17⅛—18	5 11 1	12⅛—12⅜
16,362,910	Stk.	Feb. 12	4/17/4	Gas Light and Coke { 4 p.c. Ord.	98—102	4 15 6	77⅜—79
2,600,000	,,	,,	3½	Gas Light and Coke { 3½ p.c. max.	76—79	4 8 7	60—60½
4,062,235	,,	,,	4	Gas Light and Coke { 4 p.c. Con. Pref.	96—99	4 0 10	72½—73½
4,674,850	,,	June 11	3	Gas Light and Coke { 3 p.c. Con. Deb.	72½—74½	4 0 6	62⅝—63¼
130,000	,,	,,	10	Gas Light and Coke { 10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	Hongkong & China, Ltd.	16½—16⅝	6 11 4	..
—	—	—	—	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7½	Ilford A and C	151—154	5 2 4	..
65,790	,,	,,	6⅔	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	Imperial Continental	150—160	5 12 6	63½
1,335,000	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
300,242	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
661,000	Stk.	Feb. 26	10	Liverpool 5 p.c. Ord. { A	211—213	4 13 11	93½
718,100	,,	,,	7	Liverpool 5 p.c. Ord. { B	146—14	4 14 7	
305,083	,,	June 26	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d	
75,000	5	June 11	6	Malta & Mediterranean	4⅛—4½	6 9 9	..
250,000	100	April 1	4½	Met. of Melbourne { 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	Monte Video, Ltd.	11⅛—12	6 13 4	..
1,775,892	Stk.	July 29	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	84½
529,705	Stk.	June 26	3½	Do 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	North Middlesex 7 p.c.	14—15	5 3 8	..
800,000	Stk.	May 14	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	Ottoman, Ltd.	7⅛—7⅜	6 9 0	..
60,000	50	Feb. 26	12	Portsea, Island B	128—131	4 19 8	..
100,000	50	,,	12	Do. C	118—121	4 19 2	..
52,000	50	,,	10	Do. D	..	—	..
249,980	5	April 29	8	Primitiva Ord.	5⅛—6	6 13 4	..
499,960	5	June 26	5	,, 5 p.c. Pref.	4½—5	5 0 0	3½
521,600	100	June 2	4	,, 4 p.c. Deb.	91—98	4 6 0	..
—	—	—	—	,, ,, 1911	..	—	..
846,198	Stk.	June 26	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	San Paulo { 6 p.c. Pref.	10½—11	5 9 1	..
125,000	5	July 1	5	San Paulo { 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk	Mar. 12	10	Sheffield A	238—294	4 9 8	..
209,984	,,	,,	10	Do. B	292—294	4 9 8	..
593,500	,,	,,	10	Do. C	290—292	4 10 1	..
90,000	10	May 28	9	South African	10½—11½	7 16 6	..
6,429,895	Stk	Feb. 12	5/4/0	South Met., 4 p.c. Ord.	111—113	4 16 8	76—77
1,895,445	,,	July 10	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	59½—61
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	5 8 5	..
60,000	,,	,,	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
—	—	—	—	Do. West Kent.	..	—	..
137,058	,,	June 26	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	Tottenham { A 5 p.c.	135—138	5 8 8	..
742,275	,,	,,	6	Tottenham { B 3½ p.c.	115—117	5 2 7	..
181,255	,,	June 26	4	District { 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
				Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8½	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6½	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/8	,, C 3½ p.c.	110—115	5 2 0	..
352,000	,,	,,	6½	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6½	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

The Anglo-Romano Gas Company announce that it has been decided, as a precautionary measure, in view of the continuance of the abnormal state of affairs, not to pay an interim dividend against Coupon No. 9.

Flooding of streets and houses, and interference with the tramway service in Aston, resulted from a water-main burst on Monday of last week. The main in question, a 30-inch one, was that running from Whitacre to Birmingham.

The new season's fire booklet of the Parkinson Stove Company, Limited, of Birmingham [which is provided with an artistic coloured wrapper], gives, with a number of well-known designs of the firm, illustrations and particulars of a new series of fires, introduced in order to meet the demand for apparatus to suit the modern style of furnishing and decoration. These combine with a handsome appearance all the latest improvements in fire construction introduced by the Company.

In a booklet, with a coloured wrapper eminently appropriate to the title of "For Hearth and Home," Messrs. Fletcher, Russell, and Co, Limited, of Warrington, illustrate and describe briefly their numerous patterns of modern gas fires and geysers; a supplement being devoted to the new "Classic" series of fires, designed to harmonize with decorations and furnishings in historic styles. The patterns included in this "Classic" series, which are for recessed fireplaces, were favourably commented upon in an illustrated article appearing in the "JOURNAL" for Sept. 14, p. 570. A separate booklet is available dealing with the firm's radiators.

The Sheffield University have decided to conduct scientific research in connection with the glass-making industry, and to conduct classes, so as to enable this country to capture those branches of the trade which have hitherto been left to Austria and Germany.

A series of leaflets have been prepared by Messrs. Goodall, Clayton, and Co., of Leeds, furnishing particulars regarding the working of various installations on the "Intermittent" vertical retort system, constructed by them under licence from the Vertical Gas-Retort Syndicate, Limited. The information will prove useful to gas engineers.

A copy is to hand from the Pneumatic Gas Lighting Company, Limited, Farringdon Street, E.C., of the illustrated catalogue for the season 1915-16 of the pneumatic distance gas lighter, with accessories. The Company's specialities are so well known in the industry that it is unnecessary here to allude to them in detail; but, as an indication of their popularity, it may be mentioned that the present catalogue is a much larger one than has been issued in previous years.

Notices have been issued by the Barrow-in-Furness Corporation calling attention to the critical position which has arisen owing to the depletion of the reservoirs. To convince the public of the state of affairs, Mr. F. Chadderton (the Gas and Water Works Manager) has had photographs of the Harlock reservoir prepared for distribution. The reservoir in normal times contains 226 million gallons; and lately no water could be drawn from it. The trouble has been caused by the persistent drought, which also had its effect in many other towns, and by an abnormal drain on the resources for industrial purposes.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ASSISTANT SUPERINTENDENT. No. 6105.
TESTERS (Gas-Fires, &c.). No. 6107.
GAS RENTAL CLERK. Smethwick Gas Department. No. 6109.

Appointments Vacant, &c., *(continued)*.

WORKS FOREMAN. Grantham Gas-Works.
WORKS FITTER AND TURNER. No. 6110.
FITTERS. No. 6106.
BLACKSMITH. Aldershot Gas, Water, and District Lighting Company.

Process Wanted.

NAPHTHALENE SEPARATION AND REFINING. No. 6104.

TENDERS FOR

Fire-Clay Goods.

SHEFFIELD GASLIGHT COMPANY. Tenders by Nov. 2.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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See Illustrated Advertisement, Aug. 24, p. 421.

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